Draft Final
Sampling and Analysis Plan
for Outdoor Ambient Air Monitoring at the
Libby Asbestos Site
Libby, Montana

September 5, 2006

Contract No. DTRS57-05-D-30109
Task Order No. 00006

Prepared for:

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Contents

Acronyms

BNSF	Burlington Northern Santa Fe
CAR	Corrective Action Request
CDM	CDM Federal Programs Corporation
COC	chain-of-custody
DQOs	data quality objectives
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
FSDS	field sample data sheet
FSP	field sampling plan
HASP	health and safety plan
HQ	hazard quotient
ISO	International Organization for Standardization
KDC	Kootenai Development Corporation
LA	Libby amphibole
MCE	mixed cellulose ester
MET	meteorological
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
OU	operable unit
PCM	phase contrast microscopy
PLN	Poisson lognormal
PM	project manager
PPE	personal protective equipment
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RfC	cumulative reference concentration
RPM	remedial project manager
SAP	sampling and analysis plan
S/cc	structures per cubic centimeter
SOP	standard operating procedure
TEM	transmission electron microscopy
TWF	time weighted fraction
UCL	upper confidence limit
um	micrometer
Volpe Center	John A. Volpe National Transportation Systems Center
%	percent

Section 1
Introduction

This document serves as the sampling and analysis plan (SAP) for an outdoor ambient air monitoring program to be initiated in September 2006 as part of the ongoing remedial investigation for the Libby Asbestos Site Operable Unit (OU) 4. This SAP outlines the sampling and analysis to be conducted by CDM Federal Programs Corporation (CDM) personnel during the collection of outdoor ambient air samples within the Libby Valley.

This SAP contains the elements required for both a field sampling plan (FSP) and quality assurance project plan (QAPP). This SAP has been developed in accordance with the *Environmental Protection Agency (EPA) Requirements for Quality Assurance Project Plans* (EPA 2001) and the *Guidance on Systematic Planning Using the Data Quality Objectives Process – EPA QA/G4* (EPA 2006a).

The purpose of this SAP is to describe the sampling objectives, locations, measurement methods, and data quality objectives (DQOs) for the outdoor ambient air sampling program. The SAP is organized as follows:

Section 1 - Introduction
Section 2 – Site Background
Section 3 – Data Quality Objectives
Section 4 – Sampling Program, Rationale, and Locations
Section 5 – Laboratory Analysis and Requirements
Section 6 – Assessment and Oversight
Section 7 – Data Validation and Usability
Section 8 - References

Appendices

Appendix A – Standard Operating Procedures (SOPs)
Appendix B – Stationary Air Field Sample Data Sheet (FSDS)
Appendix C – Outdoor Ambient Air Sampling Program Daily Impact/Observation Memorandum
Appendix D – Libby Asbestos Project Record of Deviation Form
Appendix E – Example of Equipment Shelter

1.1 Objectives

This section defines objectives of the ambient air monitoring program and the intended use of the data.

As determined by previous investigations conducted at the Site, Libby amphibole (LA) is present in multiple environmental media in Libby including: indoor air, outdoor ambient air, indoor dust, vermiculite insulation, and soils. As a result, residents of Libby may be exposed to LA, and these exposures may pose a risk of

cancer and/or non-cancer effects. One pathway that is of potential concern to EPA is inhalation of LA in outdoor ambient air.

There are two objectives of the program. The first objective is to collect data of sufficient representativeness and quality to estimate the human health risks associated with inhalation of LA in outdoor ambient air in and around the town of Libby. Estimates of human health risks require the characterization of the long-term average concentrations of LA. The second objective is to collect data to characterize the spatial patterns and temporal trends of LA occurrence in outdoor ambient air within the study area at the Libby Superfund Site.

The specific activities detailed in this SAP will be used to implement and conduct a monitoring program for outdoor ambient air in the Libby Valley. Sampling will be conducted at a specified frequency from multiple locations chosen to provide spatial coverage of study area.

1.2 Project Schedule and Deliverables

Sampling is expected to begin September 2006 and will continue on a regular schedule until the EPA risk assessment and management teams determine that the amount of data collected is sufficient to support final decision-making for this exposure pathway. Interim data reports summarizing all outdoor ambient air data collected to date will be generated no less than once every two months in order to keep project managers informed as to the data and findings.

Section 2
Site Background

This section describes the site location, history, and information regarding previous outdoor ambient air data.

2.1 Site Location

The Libby Asbestos Site is located within Sections 3 and 10, Township 30 North (T30N), Range 31 West (R31W) of the Libby Quadrangle in Lincoln County, Montana (Figure 2-1). The Site includes homes and other businesses, which may have become contaminated with asbestos fibers as a result of the vermiculite mining and processing conducted in and around the City of Libby.

2.2 Site History

Since 1999, the EPA has been conducting sampling and cleanup activities to address highly contaminated areas in the Libby Valley. The EPA investigation was initiated in response to media articles, which detailed extensive asbestos-related health problems in the Libby population. While at first the situation was thought to be limited to those with direct or indirect occupational exposures, it soon became clear that there were multiple exposure pathways and many persons with no link to mining-related activities were affected.

The site was listed on the Superfund National Priorities List (NPL) in February 2002.

For long-term management purposes, the Libby Asbestos Site has been divided into seven OUs:

- OU1. The former Export Plant is defined geographically by the property boundary of the parcel of land that included the former Export Plant.

- OU2. The exact geographic area of OU2 has not yet been defined, but includes areas impacted by contamination released from the former Screening Plant. These areas include the former Screening Plant, the Flyway property, the Highway 37 Right of Way adjacent to the former Screening Plant and Rainy Creek Road, the Wise property, and the Kootenai Development Corporation (KDC) Bluffs. The KDC Bluffs area is located directly across the Kootenai River from the former Screening Plant.

- OU3. The mine OU includes a) the former vermiculite mine; b) the geographic area (including ponds) surrounding the former vermiculite mine that has been impacted by releases from the mine, including Rainy Creek and the Kootenai River; and c) releases along Rainy Creek Road. The exact geographic area of OU3 has not yet been defined but will be based primarily upon the extent of contamination associated with releases from the former vermiculite mine.

- OU4. OU4 is defined as residential, commercial, industrial, and public properties, including schools and parks. OU4 includes highway corridors.

- OU5. The former Stimson Lumber Mill is defined geographically by the parcel of land that included the former Stimson Mill.

- OU6. The rail yard owned and operated by the Burlington Northern and Santa Fe Railroad (BNSF) is defined geographically by the BNSF property boundaries and extent of contamination associated with the rail yard. OU6 includes railroad transportation corridors.

- OU7. The Troy OU includes all residential, commercial, and public properties within the town of Troy.

EPA is conducting a baseline human health risk assessment for OU4. The baseline human health risk assessment will be incorporated into the remedial investigation and feasibility study for OU4. This outdoor ambient air monitoring plan is focused on collecting data to support the human health baseline risk assessment for OU4. Although outdoor ambient air in OU4 may be impacted by any activity that causes LA to be released from a source, it is currently believed that the main source of LA in outdoor ambient air in the vicinity of Libby is release from contaminated soil in and around the community. This is because contaminated soils occur in multiple locations in and around Libby, and because major waste piles and other obvious sources of LA are believed to have been removed from Libby. The remaining contaminated soils can serve as a continuous source of LA release into the air. Releases of LA from soil into outdoor ambient air may be due either to wind blowing over the soil, or from a variety of disturbances of the soil by human activities which occur randomly.

2.3 Summary of Outdoor Ambient Air Monitoring in Libby

Beginning around 2000 and continuing through the year 2002 , EPA collected outdoor ambient air samples at a number of locations around Libby in order to gain an initial understanding of the levels of LA typically observed in outdoor air. Locations where samples were collected included:

- Fitness Center at the City Hall Building (952 East Spruce Street)
- McGrade Elementary School (899 Farm to Market Road)
- Plummer Elementary School (247 Indian Head Road)
- Rainy Creek Road (various locations from intersection with Highway 37 to turnouts along the road to the mine summit)
- Lincoln County Courthouse Annex (418 Mineral Avenue)
- Lincoln County Landfill
- Station FA-1 (on the northwestern boundary of the River Runs Through It subdivision)
- Stimson Lumber Property

These samples were collected to support various removal and sampling programs. Details regarding sample collection procedures and analytical methods are described in the Summary of Asbestos Levels in Ambient Air in Libby, Montana report prepared by EPA (EPA 2006b). At some locations, air samples were collected over the

entire three-year period. At other locations, air samples were collected for less than three years.

In addition, samples of outdoor ambient air were collected at 27 properties in Libby where EPA clean-up activities were scheduled. These samples were collected before clean-up began, and the measurements were intended to help determine if the clean-up activities caused a measurable release to outdoor ambient air. These samples were collected and analyzed in accordance with the Draft Final Response Action Work Plan (CDM 2003a). The duration of sampling at these individual properties was limited to one to two days.

The results of these samples were evaluated in the Summary of Asbestos Levels in Ambient Air in Libby, Montana report (EPA 2006b). The conclusions of this report were as follows:

- The presence of LA fibers was identified in outdoor ambient air samples collected around the Libby community.
- Sources of the LA fibers found in outdoor ambient air in Libby are not known with certainty, but it seems likely that windborne transport of fibers present in soils and dust around the community is one important component.
- Concentration levels do not appear to be substantially different at different locations within the main residential-commercial section of Libby, but may be higher closer to the mine.
- Current data are too limited to determine if any time trend towards reduced levels in outdoor ambient air is occurring as a result of on-going EPA clean-up activities, but collection of additional current and future outdoor ambient air data will help answer this question.

The conclusions of the ambient air summary report are limited by the following:

- Data presented in the report are incomplete because of lack of seasonal and geographic representation over time, and there are an insufficient number of data points at adequate sensitivity.
- The preliminary analyses presented assume that "non-detect" values are equal to zero. USEPA Region 8 is currently reviewing this approach for analyzing "non-detect" results.
- The methodology for estimating risk ranges is preliminary and should be considered draft.
- Evaluation of risk in the document is limited to a single pathway and does not address cumulative exposure from multiple pathways at the Site.

EPA identified the need for further investigations of outdoor ambient air in Libby and its vicinity, specifically: collection of additional outdoor ambient air data; refinement of the methodology for estimating human health risk ranges for the Libby population; and consideration of cumulative exposures in evaluating risk.

Site Location Map
Libby, Montana

Figure 2-1

CDM

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Section 3
Data Quality Objectives

The DQO process, based on scientific methods, is a series of planning steps that are designed to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended purpose. EPA has issued guidelines to help data users develop site-specific DQOs (EPA 2006a). These guidelines were followed for the development of the DQOs presented in this section.

The DQO process specifies project decisions, the data quality required to support those decisions, specific data types needed, data collection requirements, and analytical techniques necessary to generate the specified data quality. The process also ensures that the resources required to generate the data are justified. The DQO process consists of seven steps; output from each step influences the choices that will be made later in the process. These steps include:

1. State the problem
2. Identify the decision
3. Identify the inputs to the decision
4. Define the study boundaries
5. Develop a decision rule
6. Specify tolerable limits on decision errors
7. Optimize the design

3.1 Step 1 – State the Problem

The purpose of this step is to describe the problem to be studied so that the focus of the investigation will be unambiguous.

As determined by previous investigations conducted at the Site, LA is present in multiple environmental media in Libby including: indoor air, outdoor ambient air, indoor dust, vermiculite insulation, and soils. As a result, residents of Libby may be exposed to LA, and these exposures may pose a risk of cancer and/or non-cancer effects. One pathway that is of potential concern to EPA is inhalation of LA in outdoor ambient air. However, as noted above (see Section 2.3), the current data set for LA concentrations in outdoor ambient air in Libby is not extensive enough to support risk assessment calculations for this exposure pathway with acceptable levels of confidence because the data may not be fully representative over geographic area and/or time, and because many of the data have a high (poor) analytical sensitivity, which tends to limit confidence in estimates of long-term average exposure levels.

3.2 Step 2 – Identify the Decision

This step identifies what questions the investigation will attempt to resolve and what actions may result.

The decision that EPA is seeking to make is whether the levels of LA in outdoor ambient air contribute a risk of cancer or non-cancer effects, either alone or in combination with other exposure pathways, that is within an acceptable range of risks under a reasonable maximum exposure scenario. The risk assessment will support EPA's decisions about whether additional clean-up actions (over and above those already occurring in Libby) are needed to reduce or eliminate sources of LA contamination in Libby that contribute to outdoor ambient air.

3.3 Step 3 - Identify the Inputs to the Decision

The purpose of this step is to identify the environmental data that need to be obtained and the measurements that need to be taken to resolve the decision statements.

The key environmental data required to estimate cancer and non-cancer risks from exposure to outdoor ambient air are reliable and representative (over space and time) data on the long-term average concentration of LA in outdoor ambient air within an exposure unit at the Site. These data may then be analyzed using appropriate statistical methods to determine if there are important spatial patterns (i.e., significant differences between sub-areas) or important time trends in the data (e.g., significant differences between summer and winter, a decreasing time trend as cleanup activities continue, etc.). Based on these analyses, the data may then be grouped into appropriate geographical and temporal data sets, from which long-term average values may be calculated. The long-term average value for a specified area and time frame is the key determinant of the cancer and non-cancer risk to residents and workers exposed in that area and time.

In this regard, it is important to recognize that there are several alternative strategies for specifying the concentration of asbestos in air and in using those data to estimate exposure and risk. At present, final decisions have not been made regarding which approach(es) will be used, so it is important that the data obtained provide full details on the particle size (length, width, mineral type) of all asbestos structures observed, so that these data can be used to compute the appropriate concentration values for use in whatever alternative risk models may be selected for use at the Site.

3.4 Step 4 - Define the Boundaries of the Study

This step specifies the spatial and temporal boundaries of this investigation.

Spatial Bounds

The study will focus on collection of data from OU4 that are representative of the main residential-commercial area of the Libby Valley. This area is indicated in Figure 3-1. This area is selected as the focus of this program because this is where the majority of area residents and workers live and work. Levels of LA in outdoor ambient air in other parts of OU4 as well as locations associated with other Operable Units (e.g., the mine, Rainy Creek Road, Stimson Lumber, the former Screening Plant, Export Plant and other former processing facilities, the community of Troy, etc.) will be investigated under separate sampling designs, as necessary.

Based on the data available to date, no clear differences are apparent in average LA concentrations in different sub-locations in the main residential commercial area of Libby (identified as Zones 1, 2 and 3 in the ambient air summary report [EPA 2006b]). Therefore, it may be appropriate to consider the main residential-commercial area of the Libby Valley as one exposure unit and to calculate the long-term average concentration of LA in outdoor ambient air by combining all the data . However, if the new data reveal important spatial variations in long-term average outdoor ambient air levels, then it may be appropriate to subdivide the main area of Libby into two or more sub-areas, each of which would be considered separate exposure units and would be evaluated separately for this pathway.

In addition to samples in the main residential-commercial parts of Libby, samples will also be collected at several stations that are well removed from the Libby Site such that impact from past or present releases of LA are not expected to be of concern. Data from these stations will be used to assess the magnitude of Site-related releases to outdoor ambient air.

Temporal Bounds

The program will begin in September 2006. At present, the duration of the monitoring program cannot be stated with certainty, since the magnitude of temporal variability (by day, by season, by year) is not yet known. Further, the magnitude of any effect of on-going clean-up actions on outdoor ambient air levels is not known. However, in order to ensure that temporal variability on the scale of days and months is adequately captured in the data set, it is expected that the program will endure a minimum of 1 year. If it is determined that there is a need to capture additional data to improve the temporal representativeness of the data set and/or to collect data that will allow an assessment of long-term trends that may be resulting from on-going cleanup activities, then it is expected that the program would be extended for several additional years. These decisions will be made by the risk managers once the data collected from the initial year are collected, and after consultation with EPA's scientific support team at the Site.

3.5 Step 5 - Develop Decision Rules

The purpose of this step is to describe the method that EPA will use to make final risk management decisions from the data.

At present, risk management decision rules for the Site have not yet been defined. Because outdoor ambient air is only one of several exposure pathways that will be evaluated as part of the baseline human health risk assessment, it is expected that the decision rule for outdoor ambient air will take the form that the residual cancer and non-cancer risk associated with the reasonable maximum exposure scenario contributed by this pathway may not exceed some specified level (either an absolute level or alternatively, some proportion of the total risk).

In the absence of a quantitative decision rule, it is tentatively assumed for the purposes of planning the monitoring program that if risks associated with inhalation of outdoor ambient air under reasonable maximum exposure conditions approach or exceed a cancer risk level of 1E-05 (one in 100,000) or a non-cancer Hazard Quotient

(HQ) of 0.1, the outdoor ambient air pathway may be an important contributor to the total cumulative risk and that, in this case, the sampling program should have a high ability to detect and reliably quantify the ambient air levels. This assumption is for planning purposes and should not be interpreted as a risk management decision since final risk management decisions will consider the cumulative risk of exposure to multiple exposure pathways. This assumption is used only to support initial efforts to plan the monitoring program.

3.6 Step 6 - Specify Tolerable Limits on Decision Errors

The tolerable limits on decision errors, used to establish performance goals for the data collection design, are specified in this step.

In making risk management decisions with calculated estimates of exposure and risk, two types of decision errors are possible:

- A Type I (false negative) decision error would occur if a risk manager decides that exposure to outdoor ambient air is not of significant health concern, when in fact it is of concern.

- A Type II (false positive) decision error would occur if a risk manager decides that exposure to outdoor ambient air is above a level of concern, when in fact it is not.

EPA is most concerned about guarding against the occurrence of Type I errors, since an error of this type may leave humans exposed to unacceptable levels of LA in outdoor ambient air. For this reason, it is anticipated that exposure assessment for this pathway will be based on the best estimate and the 95% upper confidence limit (UCL) of the long-term average concentration of LA in the area being evaluated. Use of the UCL to estimate exposure and risk helps account for limitations in the data, and provides a margin of safety in the risk calculations, ensuring that risk estimates are unlikely to be too low.

EPA is also concerned with the probability of making Type II (false positive) decision errors. Although this type of decision error does not result in unacceptable human exposure, it may result in unnecessary expenditure of resources. For the purposes of this effort, the strategy adopted for controlling Type II errors is to ensure that if the risk estimate based on the 95% UCL is above EPA's level of concern for this pathway, then the UCL is not larger than 3-times the best estimate of the mean. If the 95% UCL is at or above the range that is of potential concern, and the UCL is greater than 3 times the best estimate of the mean, then more data may be needed.

3.7 Step 7 - Optimize the Design for Obtaining Data

This step identifies a resource-effective data collection design for generating data that are expected to satisfy the DQOs.

Estimating the Number of Samples Required

The method used to compute the UCL of a set of outdoor ambient air samples depends on the statistical properties of the data set. Analysis of data available to date

indicates that the variability between outdoor ambient air samples may be approximated by a mixed Poisson lognormal (PLN) distribution. Statistical procedures are available to estimate the parameters of the underlying lognormal distribution (Haas et al. 1999), and these fitted parameters may be used to compute the UCL of the mean using the approach for lognormal data sets described in EPA 1992a. Based on this approach, the ratio of the UCL to the mean of a data set (an indication of the statistical uncertainty in the data) is given by

$$\frac{UCL}{Mean} = \exp[\sigma H / \sqrt{(n-1)}]$$

where:

σ = log standard deviation of the measured values
H = statistic described in USEPA (1992)
n = number of samples

Based on available data for air samples from the study area (Zones 1-3 identified in the ambient air summary report (EPA 2006b)), a rough approximation for σ for outdoor ambient air samples from the main part of Libby is 1.9. Figure 3-2 (center line) illustrates the ratio of the UCL to the mean as a function of n for an assumed σ of 1.9. As seen, the ratio (a measure of uncertainty) approaches a value of about 2 as the number of samples approaches about 80-100, and continues to decline slowly as the number of samples increases. Note that a similar pattern in observed for values of σ that are somewhat smaller (lower line) or somewhat higher (upper line).

Based on this analysis, it is expected that if a total of about 80-100 samples per exposure area were collected, and if the value of sigma is in the range of 1.5-2.3 (GSD = 5-10), the uncertainty in exposure estimates would be limited to less than a factor of 3, and that collection of additional samples would result in only minor decreases in uncertainty.

If resulting data (collected over a year's time) support the assumption that the entire study area represents a single exposure unit, then ample data will be collected – well beyond the required 80-100 data points per exposure unit area. However, for study planning purposes, such an assumption cannot be made *a priori*. If it is assumed that it may be necessary to divide the study area into 2-3 sub-areas to account for spatial variability, there will likely be 2-3 stations per sub-area, and this will yield 72-108 samples per year per sub-area, which will still be enough to support the study DQOs on their own. The data will be periodically evaluated to determine whether the sample variability supports application of one or more exposure units within the study area and/or whether continuance of the outdoor ambient air monitoring is warranted.

Estimating the Required Analytical Sensitivity

As noted above, for the purposes of this planning document, it is assumed that the analytical sensitivity must be sufficient to ensure reliable detection and quantification

if risks from outdoor ambient air approach or exceed a cancer risk of 1E-05 (1 in 100,000) or a non-cancer HQ of 0.1. The concentrations associated with these risk levels may be estimated as described below.

For cancer, a simplified equation for computing the risk associated with some specified concentration is:

$$\text{Risk} = C \cdot TWF \cdot UR$$

where:

Risk = risk of lung cancer or mesothelioma from the exposure being evaluated
C = long-term average concentration of asbestos (structures per cubic centimeter [s/cc])
TWF = time weighting factor (percent of full time that exposure occurs)
UR = unit risk for lifetime exposure

The target analytical sensitivity is then computed by rearranging the equation as follows:

$$\text{Target Analytical Sensitivity} \leq 1E\text{-}05 / (TWF \cdot UR)$$

For planning purposes, it is conservatively assumed that the TWF is 1.0. This corresponds to exposure to outdoor ambient air that occurs 24 hrs/day for a lifetime (actual exposures are likely to be lower than this for most people). Based on EPA's currently recommended risk model (IRIS 2006), the unit risk factor for lifetime exposure is 0.23. Thus, the level of concern for LA in air would be about:

$$\text{Target Analytical Sensitivity} \leq 1E\text{-}05 / 0.23 = 0.00004 \text{ PCM s/cc}$$

where:

PCM = phase contrast microscopy

For non-cancer effects, the basic risk equation is:

$$HQ = C \cdot (ET/24 \cdot EF/365 \cdot ED) / RfC$$

where:

HQ = hazard quotient (dimensionless)
C = long-term average concentration of asbestos in air (f/cc)
ET = exposure time (hrs/day)
EF = exposure frequency (days/yr)
ED = exposure duration (yrs)
RfC = Cumulative Reference concentration (f/cc-yrs)

However, at present, no RfC has been established for evaluating non-cancer effects from inhalation of LA, so it is not yet possible to compute an analogous level of

concern for this endpoint. In the absence of data, it is tentatively assumed that the target analytical sensitivity that is adequate for evaluating cancer risk will also be sufficient for evaluating non-cancer risks. This assumption will be re-visited when an RfC is developed.

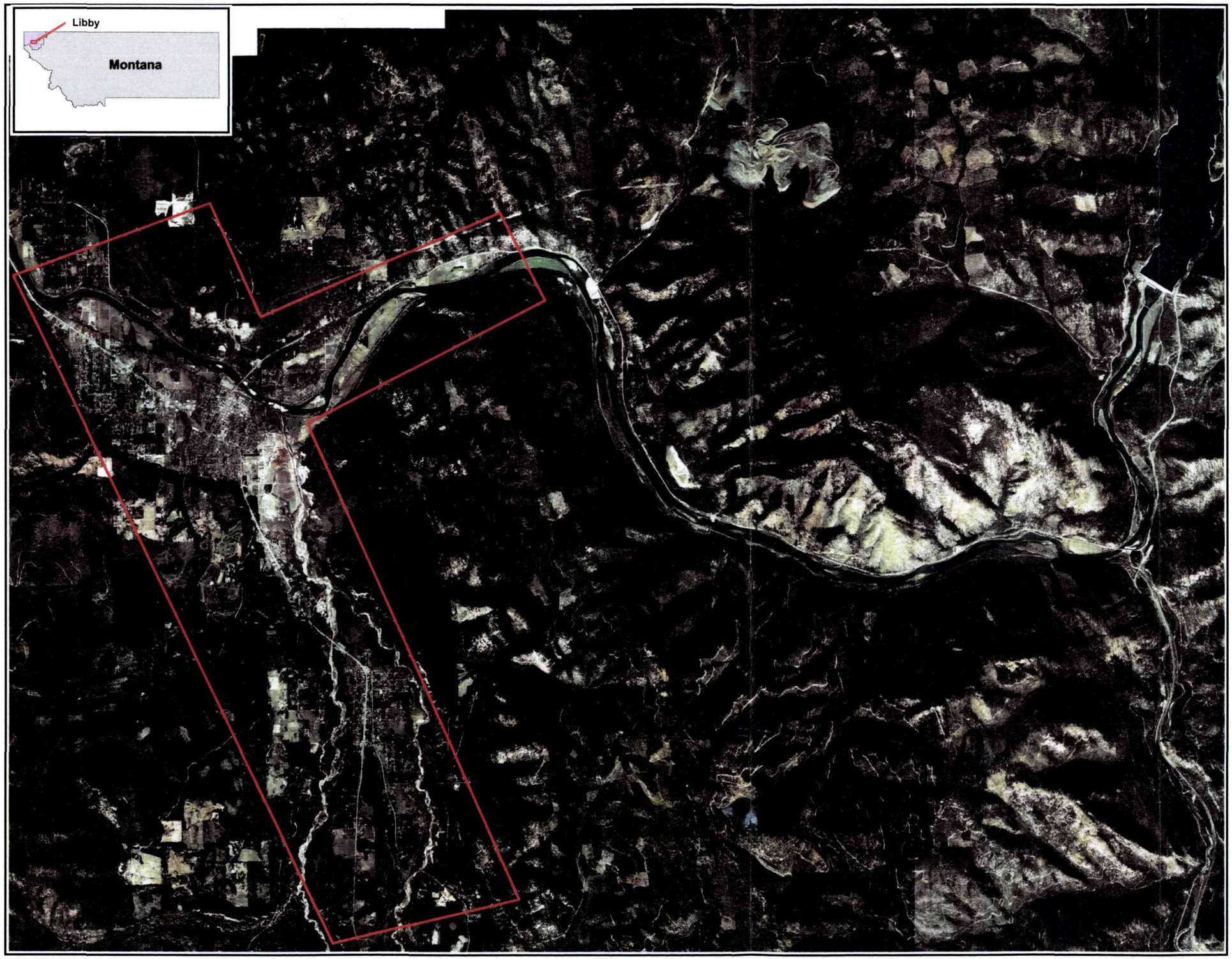
Thus, the target analytical sensitivity for outdoor ambient air samples should be ≤ 0.00004 cc^{-1}.

Refinements to the Design as Data are Collected

In accord with EPA's DQO process, it is expected that the outdoor ambient air monitoring program described in this document may be modified periodically as data are obtained. For example, if data suggest that the variability in concentrations over time is low, then EPA may decrease the number of samples collected over a specified period of time. Alternatively, if data suggest that the variability in concentrations over geographic areas is higher than expected, then additional sampling stations may be added to better characterize the spatial variability. Similarly, the target analytical sensitivity may be either increased or decreased, depending on the detection frequency and mean values observed in initial samples results, and on the RfC value when it becomes available.

Outdoor Ambient Air Study Area
Libby, Montana

Figure 3-1



Legend

Outdoor Ambient Air Investigation Boundary

0 0.5 1 2 3 Miles

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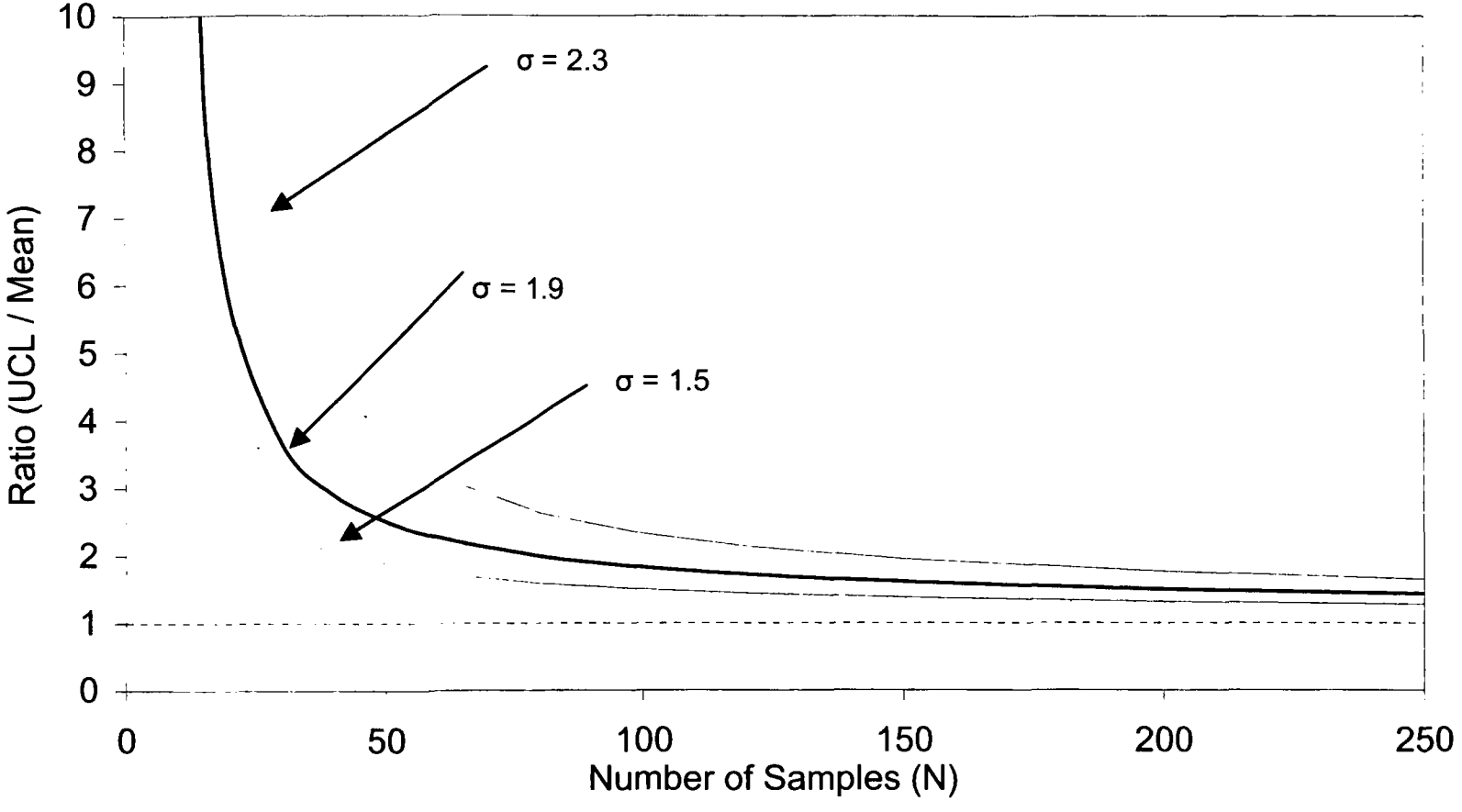
Figure 3-2 Ratio (UCL/Mean) versus Number of Samples



Section 4
Sampling Program

This section provides brief summaries of SOPs and additional site-specific detail that may not be discussed in the SOPs. The site-specific procedure will be followed during this investigation. For additional information, field personnel will refer to the SOPs included in Appendix A. The site health and safety plan (HASP) should be consulted to determine health and safety protocols for performing site work. The SOPs and site-specific procedures included in Appendix A are listed below (CDM 2005b):

- Sample Custody (SOP 1-2)
- Packaging and Shipping of Environmental Samples (SOP 2-1)
- Guide to Handling of Investigation-Derived Waste (Modified SOP 2-2)
- Field Logbook Content and Control (SOP 4-1)
- Photographic Documentation of Field Activities (Modified SOP 4-2)
- Control of Measurement and Test Equipment (SOP 5-1)
- Asbestos Air Sampling at Libby (CDM-SOP-LIBBY-AIR) - this SOP is currently under development

The following sections are a summary of field activities that will be performed in accordance with this SAP by CDM during the outdoor ambient air sampling investigation.

4.1 Pre-Sampling Activities

Prior to beginning field activities, a field planning meeting will be conducted and an inventory of supplies will be performed to determine procurements needs. The following sections discuss these pre-sampling activities.

4.1.1 Field Planning Meeting

Prior to beginning field activities, a field planning meeting will be conducted by the CDM project manager (PM) and attended by the field staff and a member of the CDM quality assurance (QA) staff as well as EPA support scientists who were instrumental in study design development. The EPA Remedial Project Manger will be notified of the date and time of the meeting. The agenda will be reviewed and approved by the QA staff and the health and safety officer prior to the meeting. The meeting will briefly discuss and clarify:

- Objectives and scope of the fieldwork
- Equipment and training needs

- Field operating procedures, schedules of events, and individual assignments
- Required quality control (QC) measures
- Health and safety requirements
- Documents governing fieldwork that must be on site
- Any changes in the field plan documents

A written agenda, reviewed by the CDM QA staff, will be distributed and an attendance list signed. Copies of these documents are maintained in the project files, in the CDM Denver office. Additional meetings will be held when the documents governing fieldwork require it or when the scope of the assignment changes significantly.

The field team personnel will perform the following activities before and during field activities, as applicable:

- Review and understand this SAP and HASP
- Ensure that all sample analyses are scheduled through the laboratory
- Obtain required sample containers and other supplies
- Obtain and check field sampling equipment
- Obtain personal protective equipment (PPE)

4.1.2 Inventory and Procurement of Equipment and Supplies

The following equipment will be required for sampling activities, and any required equipment not already contained in the field equipment supply inventory will be procured prior to initiation of sampling activities:

- Field logbooks
- Indelible ink pens
- Digital camera
- Sample media: 0.8 micrometer (um) pore size, 25-millimeter diameter mixed cellulose ester (MCE) filter cassettes.
- Sample paperwork and sample tags/labels
- Custody seals
- Zipper-top baggies
- Air sampling equipment as described in CDM-SOP-LIBBY-AIR
- PPE as required by the HASP

4.1.3 Community Coordination

Prior to the implementation of the sampling events described in this SAP, the owner of each property where sampling is proposed will be contacted to determine his/her desire to participate in this investigation. The property owner will be advised of the study's duration (at least a year and perhaps longer) and will be informed of the importance of obtaining samples consistently over that extended time period. Access agreements will be obtained as required. A community involvement coordinator will contact each resident to describe the program and the potential impact to the resident (e.g., sample technicians visiting the property at regular intervals, the expected duration of the program). Each residential or commercial property participating in this investigation will be reimbursed for power used from their service to run sampling equipment.

4.2 Field Documentation

Field documentation to be generated during this sampling study includes the following: logbooks, FSDSs, photographs, and sample custody documentation. The following sections describe the types of documentation as well as how field documents will be corrected if errors occur and the process for documenting deviations from field procedures prescribed in this SAP.

4.2.1 Field Logbooks and Records

Field logbooks will be maintained in accordance with CDM SOP 4-1, Field Logbook Content and Control (Appendix A). This log is an accounting of activities at the Site and will note problems or deviations from the governing plans and observations relating to the sampling and analysis program. Field administrative staff will manage the logbooks and FSDS and will send original field logbooks, as they are completed, to the CDM project file repository in Denver, Colorado for document control. A copy of each logbook will be maintained in the CDM office in Libby, Montana.

Detailed sampling notes will be recorded for each sample on an FSDS (Appendix B). Field administrative staff will manage the FSDSs and will send copies to the CDM project file repository in Denver, Colorado for document control and a copy to the John A. Volpe National Transportation Systems Center (Volpe Center) for data entry required in the project database. Original FSDSs will be maintained in the CDM office in Libby, Montana.

For each day that outdoor ambient air samples are collected in association with this SAP, a Daily Impact/Observation Memorandum will be completed. An example of this memorandum is included in Appendix C. The purpose of this memorandum is to capture, in an easy to access format, any actions or issues that could affect the results or viability of an outdoor ambient air sample.

4.2.2 Photographic Documentation

Photographic documentation will be recorded for each sampling location (at first collection event) and at any place the field sampling personnel determine necessary with a digital camera in accordance with CDM SOP 4-2, Photographic Documentation of Field Activities (Appendix A) with the following site-specific modifications.

Section 5.2.2, General Guidelines for Still Photography - A slate is not required for each new roll of film. The information for the slate will be recorded in the field logbook (e.g., direction of the photograph, surrounding landmarks, etc.). All team members, as stated in the logbook, will be photographers and witnesses at the locations. Slates are not required for close-up photographs, and instead the required information can be listed in the digital photograph file name. File names will be in the format: last name of property owner_address_AAS_date, where:
AAS = Ambient Air Sampling
Date = MM/DD/YY

A color strip is not required for close-up or feature photographs.

Section 5.2.4, Photographic Documentation - The name of the laboratory, time and date of drop-off, and receipt of film are not required to be recorded for this project.

Section 3.3.2, Archive Procedures - Digital photographs will be archived on the CDM Libby Server (secure) with nightly backup. These files will be archived until project closeout, at which point project management will determine a long-term electronic file storage system.

4.2.3 Sample Labeling and Identification

Samples will be labeled with index identification numbers supplied by field administrative staff, and will be signed out by the sampling teams (i.e., controlled). One sample label will be placed on the sampling cassette. The sample identification number will also be written on the outside of the plastic bag used to hold the sampling cassette during transport.

Sample index identification numbers will identify the samples collected during the outdoor ambient air study by having the following format:

AA-#####

Where: AA = Ambient air
= a sequential five digit number

4.2.4 Field Sample Custody and Documentation

Sample custody and documentation will follow the requirements specified in CDM SOP 1-2, Sample Custody (Appendix A). All samples and sampling paper work will be relinquished to the sample coordinator at the end of each day. Field administrative staff will be responsible for management of all field forms.

4.2.5 Corrections to and Deviations from Documentation

Logbook modification requirements are described in CDM SOP 4-1, Field Logbook Content and Control (Appendix A). For the logbooks, a single strikeout initial and date is required for documentation changes. The correct information should be entered in close proximity to the erroneous entry. These procedures will also be followed for the correction of any field form. All deviations from the guiding documents will be recorded on the Daily Impact/Observation Memorandum

(Appendix C) and the Libby Asbestos Project Record of Modification Form (Appendix D). Any major deviations will be documented according to the CDM quality management plan (CDM 2005a).

4.3 Outdoor Ambient Air Sampling

The following sections describe the process of selection of outdoor ambient air sampling locations, the procedures for sample collection, and requirements for collection and submission of QA/QC samples.

4.3.1 Selection of Outdoor Ambient Air Sampling Locations

Outdoor ambient air sampling will be conducted at 14 specified locations in the main residential/commercial area of Libby (Figure 4-1). This number of stations was selected so that, if the data indicate that it is necessary to divide the study area into 2-3 sub-areas to account for spatial variability in long-term averages, there will likely be at least 3-5 stations present in each sub-area, which will help ensure that the data set for each sub-area remains spatially representative.

The locations of these 14 stations were selected using a stratified random approach, in which the study area was divided into 14 grids, and 1 location was selected within each grid. The specific location within each grid was chosen on a random basis by selecting locations that have available electricity and could be accessed year-round. This is important to help ensure that the stations will provide adequate spatial coverage of the study area.

In addition to the 14 outdoor ambient air sampling locations shown in Figure 4-1, two background samples will be collected; in Eureka and Helena, Montana. Eureka was chosen because it is a location known to have buildings with vermiculite attic insulation. The Eureka sample will be collected at the city office building located at 108 Dewey Avenue. The Helena sample will be collected at the local CDM office located at 50 West 14th Street.

Meteorological (MET) data station data will be downloaded daily from the internet for the following weather stations as reported hourly by the National Oceanic and Atmospheric Administration (NOAA):

- Libby Fire Cache (NOAA station identification = LBBM8)
- Eureka (NOAA station identification = EURM8)
- Helena Regional Airport (NOAA station identification = KHLN)

Although not considered necessary for the calculation of risk data, MET data may be used to understand temporal patterns of results and sample representativeness.

4.3.2 Sampling Protocol

Outdoor ambient air samples will be collected and equipment calibrated in accordance with CDM-SOP-LIBBY-AIR which is based on EPA SOP #2015 (Appendix A) for asbestos air sampling. In brief, outdoor ambient air sampling pumps will be placed on the east or west side of buildings approximately 15 feet away from outer walls to reduce building interference with wind patterns and allow the samples to be exposed to the dominant northwest to southeast air patterns in the valley. Sample

locations will be chosen so that particulates generated by automobile traffic on dirt and gravel roads will be minimized.

Equipment shelters, such as those shown in Appendix E, will be used to house the sampling pumps. The use of these shelters will protect the sampling equipment from adverse weather conditions that would otherwise interfere with the collection of year-round samples.

4.3.2.1 Collection Interval and Flow Rates

In order to help ensure that target analytical sensitivities can be achieved, the target volume of air to be collected for each sample will be 14,000 liters. To help ensure that samples capture temporal variability, each sample will be collected over a 5 day (120 hour) interval. Thus, the target flow rate is approximately 2 liters per minute. At each station, a second sample will be collected with a lower flow rate (1.5 liters per minute) over the same period of time. This sample is intended to serve as a backup for use if the sample collected at the higher flow rate is overloaded. This, the low flow sample will initially be archived, and will not be analyzed unless the primary sample is overloaded.

As samples are initially collected during this program and analyzed, these flow rates and sample times may be adjusted to ensure the sample filter has proper loading for the required analytical analysis and sensitivity goals.

4.3.2.2 Sampling Schedule

At each station, sampling will occur on a regular 10 day schedule. This will result in the collection of 36 samples per year per station. Table 4-1 shows an example of the staggered schedule for the first month of the investigation. The schedule presented in Table 4-1 is only intended to provide an example for execution, and specific start dates for each sample location may be adjusted.

Sample collection will begin over a 3 to 4 hour period on a predetermined day of the week. During the first two weeks of sampling collection, every sample will be checked every 3 to 4 hours, after that each sample cassette will be checked every 6 to 8 hours for visible loading. If visible loading is observed on a filter, or if decreased flow is noted due to filter plugging, the collection of that sample will be concluded, duration of collection will be noted, and the sample submitted for analysis. Samples will not be submitted on more than one cassette if visible loading is observed, instead the analysis of the sample will be modified (more grid openings counted) to ensure the appropriate analytical sensitivity is reached.

The sampling schedule and techniques for the Helena station will be the same as for stations in Libby. Due to the remote location of the Eureka sampling location (70 miles north-northeast of Libby), samples from this station will be collected over a 32-hour period once a week. To account for the shorter sampling period, somewhat higher flow rates (8 and 5 liters/minute) will be used so that the sample volumes collected will be similar to the volumes that will be collected in Libby.

Sampling may be suspended if adverse weather conditions exist (e.g., precipitation that could interfere with sample viability and/or equipment function, hazardous

winter road conditions). If this occurs, the EPA RPM will be notified immediately. It is suspected that due to the use of the equipment shelters (Appendix E) sampling will only be affected by extreme weather.

4.3.2.3 Filter Type

Samples will be collected using 25-millimeter diameter, 0.8 um pore size MCE filter cassettes. The choice of 0.8 um pore size is based on the fact that most air samples collected in Libby to date have used this pore size.

In order to investigate whether the choice of pore size is an important determinant of observed concentrations, samples using 0.45 um pore size filters will also be collected during the first two sampling events at the following six stations:

- 1915 Kootenai River Road
- 1593 Highway 2 W
- 60 Port Blvd
- Cabinet View Golf Course
- 475 Fish Hatchery Road
- 122 Evans Rd

These locations were selected to represent 2 sampling stations from the north end of the study area, the middle of the study area, and the south end of the study area.

This will result in collection of 12 sets of paired samples (same place, same time, different pore size) that will be compared using appropriate statistical tests determine if there is any meaningful difference in samples results as a function of pore size.

4.3.2.4 Sample Height

All samples will be collected from the height of an adult's breathing zone, approximately 6 feet above ground level by using lengths of tygon tubing that reach from the sampling pump positioned near the ground to a sampling stand designed to hold the sampling media at desired heights.

In order to investigate whether levels may tend to be higher at a child's breathing height (3 feet) than at an adult's breathing height (6 feet), samples will be collected at both 3 feet and 6 feet above ground level during the first two sampling rounds at the following 6 sampling locations:

- 1915 Kootenai River Road
- 1593 Highway 2 W
- 60 Port Blvd
- Cabinet View Golf Course
- 475 Fish Hatchery Road
- 122 Evans Rd

These locations were selected to represent 2 sampling stations from the north end of the study area, the middle of the study area, and the south end of the study area.

This will result in the collection of 12 pairs of filters (same location, same time,

different heights) that will be compared using appropriate statistical methods to determine if there are any meaningful differences between the heights, and this information will be used to determine whether continued sampling at both 3 feet and 6 feet is required.

4.3.2.5 Duration of the Sampling Schedule

As noted above, the full duration of the monitoring program can not be specified with certainty at this time, but it is expected that the program will last for at least 1 year, and may extend beyond that point. Assuming that 36 samples per year are collected from each of 14 stations in the Libby study area, this will result in the collection of a minimum of 504 additional outdoor ambient air samples. As noted above, this number is expected to provide a good characterization of both geo-spatial and temporal variability, even if it is necessary to divide the study area into 2-3 sub-locations.

4.3.3 Chain-of-Custody Requirements

Chain-of custody (COC) procedures will follow the requirements as stated in CDM SOP 1-2, Sample Custody with modification (Appendix A). The COC record is used as physical evidence of sample custody and control. This record system provides the means to identify, track, and monitor each individual sample from the point of collection through final data reporting. A complete COC record is required to accompany each shipment of samples.

At the end of each day, all samples will be relinquished to the sample coordinator by the sampling team following COC procedures. The sample coordinator will follow COC procedures to ensure proper sample custody between acceptance of the sample from the field teams to shipment to the laboratory.

4.3.4 Sample Packaging and Shipping

Samples will be packaged and shipped in accordance with CDM SOP 2-1, Packaging and Shipping of Environmental Samples, with modification (Appendix A). A custody seal will be placed so that both ends of the sampling cassette are covered by the seal. If an overnight delivery service is used to ship the samples, the samples will be secured for shipment in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Vermiculite, shredded paper, or expanded polystyrene cannot be used as packing material. Plastic bubble wrap is an example of an acceptable packing material.

4.4 Equipment Decontamination

Sampling will be completed with dedicated field equipment, and equipment decontamination will not be required for the activities described in this SAP.

4.5 Handling Investigation Derived Waste

Any disposable equipment or other investigation derived wastes will be handled in accordance with CDM SOP 2-2 with Site-specific modifications, Guide to Handling of Investigation-Derived Waste (Appendix A).

4.6 QA/QC Activities

This section describes the QA/QC activities that will be conducted to ensure samples collected during this effort are of sufficient quality to meet the project DQOs.

4.6.1 Calibration and Control of Sampling Equipment

Prior to the collection of samples, sampling pumps will be calibrated to the required flow rate by use of an adequately maintained secondary calibration standard according to CDM SOP 5-1, Control of Measurement and Test Equipment (Appendix A) and EPA SOP 2015 (Appendix A).

4.6.2 Collection of QA/QC Field Samples

Three types of QA/QC samples will be collected as part of this investigation: lot blanks, field blanks, and co-located samples.

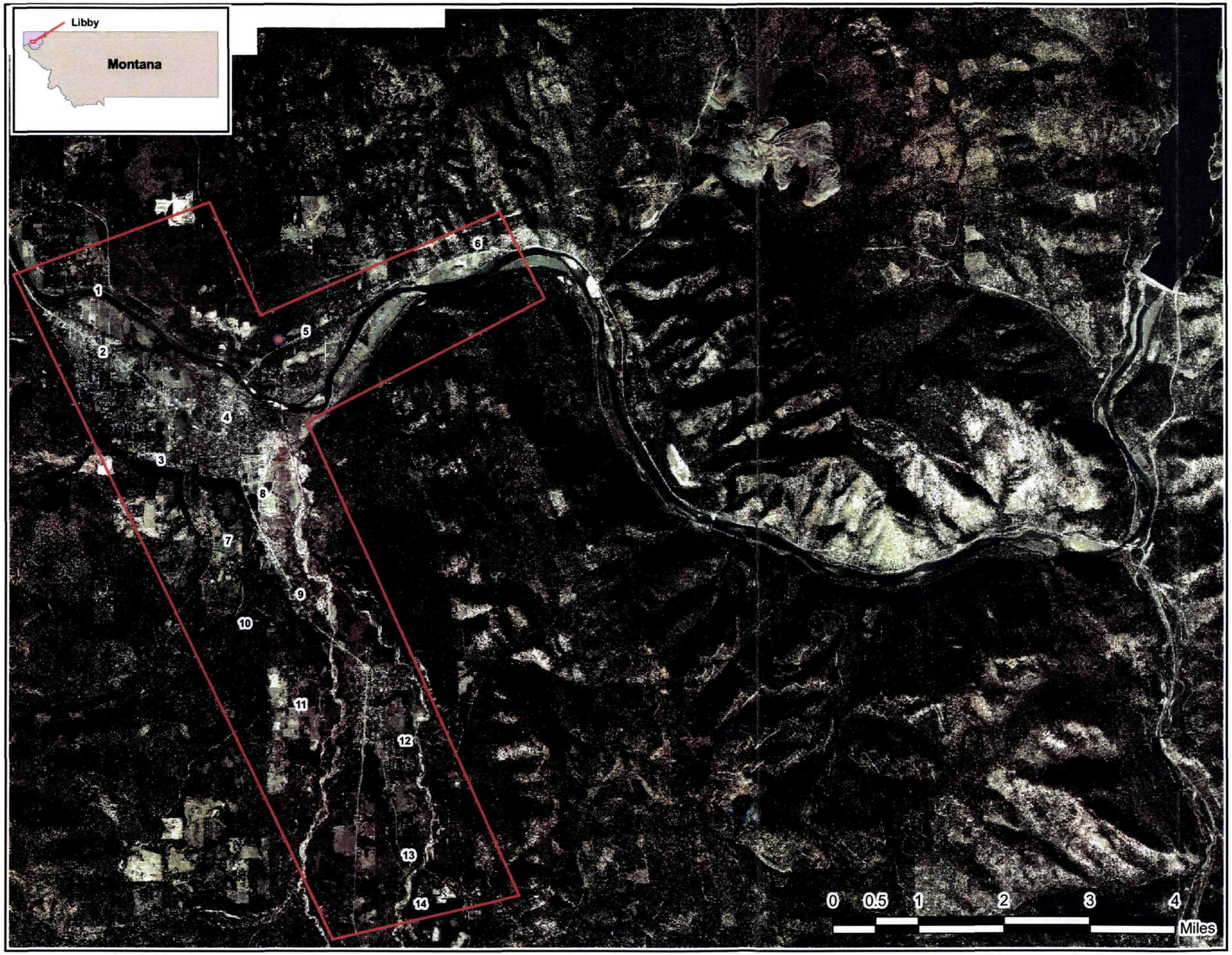
Lot blanks - Before samples are collected, two cassette lot blanks from each filter lot of 100 cassettes will be randomly selected and submitted for analysis. The lot blanks will be analyzed for asbestos fibers by the same method as will be used for field sample analysis. The entire batch of cassettes will be rejected if any asbestos fiber is detected on the lot blanks.

Field blanks - One field blank will be collected each day and one analyzed per week for this sampling study, as described in field modification LFO-000064. If asbestos fibers are observed on a field blank, other field blanks collected during that week will be submitted for analysis to determine the potential impact on sample results. The field blanks will be analyzed for asbestos fibers by the same method as will be used for field sample analysis. The blanks will be collected at varying locations throughout the week (one collected at a different location on each day of the week).

Co-located samples - Co-located samples are used to determine the variability of the measured parameter. Due to the nature of outdoor ambient air, these samples should not be used to assess error (EPA 1992b). The co-located samples are only intended to measure the variability of the measured parameter. Co-located samples will be collected at a frequency of one per week. Field co-located samples will be collected beside a field sample and given a unique index identification number. Field co-located samples should be collected from varying locations throughout the study area. The sampler will assign the same location ID to the co-located sample as the field sample, and will record the identification number of the field sample on the FSDS in the comments section. Co-located samples will be sent for analysis by the same method as field samples.

Outdoor Ambient Air Sampling Locations Libby, Montana

Figure 4-1



Legend

ID	Address
1	1915 Kootenai River Rd
2	1593 Highway 2 West
3	101 Ski Road
4	501 Mineral Ave
5	1427 Hwy 37 N
6	3733 Highway 37 N
7	378 Cabinet View
8	60 Port Blvd
9	2261 Highway 2 South
10	170 Hogan Drive
11	Corner of Snowshoe Drive and Woodland Heights
12	899 Farm to Market Rd
13	122 Evans Road
14	475 Fish Hatchery Road

MET Stations

Outdoor Ambient Air Investigation Boundary

N
W E
S

CDM

Document: M:\2603-Volpe\Libby\GIS\Fig4-1_OutdoorAmbientAirSmpling_060824.mxd

Section 5
Laboratory Analysis and Requirements

The laboratories used for all sample analysis will have participated in, and acceptably analyzed, the required parameters in the last two proficiency examinations from the National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program. The laboratory must also analyze performance evaluation samples when requested. These analyses must be performed before any samples are submitted to the laboratory to confirm the laboratory's capabilities and may be subsequently submitted at regular intervals. In addition, the laboratory must participate in the laboratory training program developed by the Libby laboratory team.

5.1 Analytical Methods

The outdoor ambient air and QA/QC samples will be submitted to a subcontracted laboratory for analysis using the International Organization for Standardization (ISO) transmission electron microscopy (TEM) method 10312, also known as ISO 10312:1995(E) (CDM 2005c) with project specific modifications LB-000016, LB-000019, LB-000028, LB-000029, LB-000029a, LB-000030 (CDM 2003b). All asbestos structures (including not only Libby amphibole but all other asbestos types as well) having length greater than or equal to 0.5 um and an aspect ratio ≥3:1 will be recorded on the Libby site-specific laboratory data sheets and electronic deliverables.

As stated in LB-000029 and LB-000029a, the frequency for laboratory-based QC samples for TEM analysis is:

Lab blank = 4%
Recount same = 1%
Recount different = 2.5%
Re-preparation = 1%
Verified analysis = 1%
Inter-laboratory = 0.5%

Due to concerns related to the efficiency of sampling pumps over the required sampling time, 0.8 um filters will be used instead of the traditional 0.45 um called for when collecting samples for TEM analysis. In addition, the use of 0.8 um filters will help reduce loading concerns typically encountered when collecting samples of long duration and high volume. Historical ambient air samples at the site were also collected on 0.8 um filters; by using these filters for this sampling program, data comparability will be improved.

All field samples collected at the higher flow rate and the appropriate number of QA/QC samples will be submitted for analysis each week in order to determine if the samples being collected can be analyzed by the ISO TEM method to the required analytical sensitivity. The on-Site laboratory will complete a preliminary analysis of 10 grid openings for each sample to ensure its readability by TEM. Completion of the sample analysis will be performed by an off-Site laboratory. The on-Site laboratory will ship the samples under proper COC to a laboratory designated by the Libby Project laboratory coordinator.

Sample Archival
All samples not planned for immediate analysis will be archived at a project laboratory as specified by the project laboratory coordinator and sent for analysis only if directed by EPA.

All samples planned for immediate analysis will be distributed to project laboratories as directed by the Libby Project laboratory coordinator. Once analyzed, all samples will be will stored (archived) at project laboratories under COC until further notice.

5.2 Analytical Sensitivity

The target analytical sensitivity for outdoor ambient air for this investigation is 0.00004 s/cc. In the event of sample loading or other issues where a sensitivity of 0.00004 s/cc can not be achieved, the laboratory may report a sample result with a higher (poorer) sensitivity *only after consultation with EPA project personnel.*

5.3 Holding Times

No preservation requirements or holding times are established for air samples collected for asbestos analysis.

5.4 Laboratory Custody Procedures and Documentation

Laboratory custody procedures are provided in the laboratory's QA management plan, which are approved by CDM as part of the laboratory procurement process. Upon receipt at the laboratory, each sample shipment will be inspected to assess the condition of the shipping container and the individual samples. This inspection will include verifying sample integrity. The enclosed COC records will be cross-referenced with all of the samples in the shipment. The laboratory custodian will sign these records and provide copies for placement in the project files. The sample custodian may continue the COC record process by assigning a unique laboratory number to each sample on receipt. This number, if assigned, will identify the sample though all further handling at the laboratory. It is the laboratory's responsibility to maintain internal logbooks and records throughout sample preparation, analysis, and data reporting.

5.5 Documentation and Records

Data reports will be submitted to the CDM laboratory coordinator and include a case narrative that briefly describes the number of samples, the analyses, and any analytical difficulties or QA/QC issues associated with the submitted samples. The data report will also include signed COC forms, analytical data summary report pages, and a summary of QC sample results and raw data, where applicable. Raw data are to consist of instrument preparation and calibration logs, instrument printouts of field sample results, QC sample results, calibration and maintenance records, COC check in and tracking, raw data count sheets, spectra, micrographic photos, and diffraction patterns. All original data reports will be filed in the CDM

project repository in Denver, Colorado. The laboratory also will provide an electronic copy of the data to the laboratory coordinator and others as directed by CDM.

5.6 Data Management

Sample results data will be delivered to the Volpe Center and CDM's Cambridge office both in hard copy and as an electronic data deliverable (EDD). Electronic copies of all project deliverables, including graphics, will be filed by project number. Electronic files will be routinely backed up and archived.

All results, field data sheet information, and survey forms will be maintained in the Libby project database managed by the Volpe Center.

Section 6
Assessment and Oversight

Assessments and oversight reports to management are necessary to ensure that procedures are followed as required and that deviations from procedures are documented. These reports also serve to keep management current on field activities. Assessment, oversight reports, and response actions are discussed below.

6.1 Assessments

Performance assessments are quantitative checks on the quality of a measurement system and are appropriate to analytical work. Performance assessments for the laboratories may be accomplished by submitting reference material as blind reference (or performance evaluation) samples. These assessment samples are samples with known concentrations that are submitted to the laboratories without informing the laboratories that they are performance samples. Samples will be provided to the laboratories for performance assessment upon request from the EPA remedial project manager (RPM) or Volpe Center PM. Laboratory audits may be conducted upon request from the EPA RPM or Volpe Center PM.

Performance samples will be submitted to each laboratory analyzing samples associated with this investigation. The submission frequency will be at least once every three months.

System assessments are qualitative reviews of different aspects of project work to check on the use of appropriate QC measures and the functioning of the QA system. Project assessments will be performed under the direction of the QA managers, who report directly to the CDM president. Quality Procedure 6.2, as defined in the CDM QA Manual (CDM 2005a), defines CDM 's corporate assessments, procedures, and requirements. Due to the amount of sampling and the duration of the Libby project, both a field audit and an office audit are scheduled for the Site annually.

6. 2 Response Actions

Response actions will be implemented on a case-by-case basis to correct quality problems. Minor response actions taken in the field to immediately correct a quality problem will be documented in the applicable field logbook and a verbal report will be provided to the CDM PM. For verbal reports, the CDM PM will complete a communication log to document the response actions were relayed to him/her. Major response actions taken in the field will be approved by the CDM PM, the EPA RPM, and Volpe PM prior to implementation of the change. Major response actions are those that may affect the quality or objective of the investigation. Quality problems that cannot be corrected quickly through routine procedures may require implementation of a corrective action request (CAR) form.

All formal response actions will be submitted to either CDM 's QA manager and/or project QA coordinator for review and issuance. CDM 's PM or local QA coordinator will notify the QA manager when quality problems arise that may require a formal response action. CAR forms will be completed according to Quality Procedure 8.1 of

the CDM QA Manual (CDM 2005a).

In addition, when modifications to this specific SAP are required either for field or laboratory activities Libby Asbestos Project Record of Modification Form (Appendix C) must be completed.

6.3 Reports to Management

QA reports will be provided to management whenever quality problems are encountered. Field staff will note any quality problems on field data sheets, or in field logbooks. CDM 's PM will inform the project QA coordinator upon encountering quality issues that cannot be immediately corrected. Weekly reports and change request forms are not required for this work assignment. Monthly QA reports will be submitted to CDM 's QA manager by the project QA coordinator.

Topics to be summarized regularly may include but not be limited to:

- Document technical and QA reviews that have been conducted
- Activities and general program status
- Project meetings
- Corrective action activities
- Any unresolved problem
- Any significant QA/QC problems not included above

Section 7
Data Validation and Usability

Laboratory results will be reviewed for compliance with project objectives. Data validation and evaluation are discussed in Sections 7.1 and 7.2, respectively.

7.1 Data Review, Validation, and Verification Requirements

No formal data validation for these media is currently required of CDM. At the request of Volpe Center, CDM will validate data submitted by analytical laboratories. Data validation consists of examining the sample data package(s) against pre-determined standardized requirements. The validator may examine, as appropriate, the reported results, QC summaries, case narratives, COC information, raw data, initial and continuing instrument calibration, and other reported information to determine the accuracy and completeness of the data package. During this process, the validator will verify that the analytical methodologies were followed and QC requirements were met. The validator may recalculate selected analytical results to verify the accuracy of the reported information. Analytical results will then be qualified as necessary.

Data verification includes checking that results have been transferred correctly from laboratory data printouts to the laboratory report and to the EDD. Data verification for this project is primarily performed as a function of built-in quality control checks in the Libby project database when data is uploaded. However, the sample coordinator will notify the laboratories and the project database manager (Mr. Mark Raney, Volpe Center) of any discrepancies found during data usage.

7.2 Reconciliation with Data Quality Objectives

Once data has been generated, CDM evaluates data to determine if DQOs were achieved. This achievement will be discussed in the measurement report, including the data and any deviations to this SAP. Sample data will be maintained in a Microsoft Access database. Laboratory QC sample data will be stored in hard copy (in the project files) and in a separate database.

Section 8
References

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Appendix A
CDM Technical Standard Operating Procedures and Site Specific Guidance Document

Project-Specific Modification

SOP No.: 1-2

SOP Title: Sample Custody

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: [signature] Date: 5/7/03

Technical Reviewer: [signature] Date: 5/7/03

QA Reviewer: [signature] Date: 5/12/03

EPA Approval: [signature] Date: 5/19/03

NOTE: Each media (soil/dust) must be submitted on separate COC forms.

The sample coordinator assistant will use the FSDS to complete an electronic chain of custody (eCOC). The sample coordinator will check the data entered to validate the eCOC against the FSDSs. Three paper copies of the eCOC will then be generated. One copy will be filed in the CDM Libby office and the other two will be sent with the samples. The sample coordinator will then check the eCOC versus the sample containers and sample shipment. The sample coordinator will be responsible for shipment of samples. If any errors are found on an eCOC after shipment, the paper copy of the COC will be corrected by the sample coordinator with a single strikeout initial and date. The corrected copy will be faxed to Volpe and the laboratory. The fax to Volpe will be used to update the Libby project database.

Reason for and duration of modification: Sample custody procedures for the Libby asbestos project vary slightly from SOP 1-2. These modifications are necessary for the entire duration of the project.

Project-Specific Modification

'ia: Hand delivery or shipped. Hand delivery refers to samples delivered by and to the onsite laboratory; shipped refers to samples sent to the laboratory by elivery service (i.e., Federal Express). To be completed by the sample oordinator.

'roject: All samples collected in accordance with this sampling and analysis lan (SAP) are part of the CSS. Circle CSS. To be completed by the field team.

ample Placed in Cooler/Bag: Refers to visual confirmation of the sample in the hipping container. To be completed by the sample coordinator.

ndex ID: Unique index identification number used to identify sample, in the orm CSS-#####. To be completed by the field team.

ample Date: The date each sample was collected, in the form MM/DD/YY. To e completed by the field team.

ample Time: The time each sample was collected, in military time. To be ompleted by the field team.

ample Matrix: The matrix of each sample collected, specific to the CSS; S = soil nd W = water. To be completed by the field team.

ample Type: Sample type of each sample collected; G = grab, C = composite. o be completed by the field team.

Volume: Specific to air and dust samples. Does not pertain to the CSS. "NA" hould be placed in this field. To be completed by the field team.

Analysis Request: Analysis of each sample collected. All soil samples will be analyzed by IR. IR will be written in the analysis request portion of the COC form by the field team. The sample coordinator and/or laboratory coordinator may request SEM analysis based on Table 5-2 of the SAP. The sample coordinator and/or laboratory coordinator will designate IR for the appropriate samples.

Comments: Any pertinent information regarding the sample (i.e., vermiculite visible) will be entered by either the field team or the sample coordinator.

Sample Received by Lab: To be checked by the sample custodian at the laboratory upon receipt of the samples to confirm presence of each sample on the COC record.

Project-Specific Modification

Total Number of Samples: Total number of samples on the COC form. To be completed by the field team.

Additional Comments: Any additional comments that relate to samples on the COC form (i.e., turn around times). To be completed by the field team or sample coordinator.

Relinquished by: (1) Signed by field team member that relinquishes samples to sample coordinator and company of person relinquishing samples to sample coordinator (i.e., CDM). Date of relinquish shall be in the form MM/DD/YY and time shall be in military time. (2) Additional relinquished by lines to be completed following standard sample custody procedures.

Received by: (1) Signed by sample coordinator that receives samples from the sampling team and company of person accepting samples from the field teams (i.e., CDM). Date and time of acceptance should be the same as date and time of relinquish. (2) Additional received by lines to be completed following standard sample custody procedures.

Sample Condition upon Receipt: Will reflect the condition of samples at the relinquish time (i.e., accept ok or not acceptable with an explanation). To be completed by the person receiving samples.

Page ___ of ___: Sequential page number of the entire COC set sent to the laboratory. To be completed by the sample coordinator.

Sample Custody

SOP 1-2
Revision: 4
Date: March 1, 2004
Page 1 of 7

Prepared: David O. Johnson
Technical Review: Shelley Thibeault
QA Review: Laura Splichal
Approved: Michael C. Molly 2/24/04
Signature/Date
Issued: 2/18/04
Signature/Date

1.0 Objective

Due to the evidentiary nature of samples collected during environmental investigations, possession must be traceable from the time the samples are collected until their derived data are introduced as evidence in legal proceedings. To maintain and document sample possession, sample custody procedures are followed. All paperwork associated with the sample custody procedures will be retained in CDM Federal Programs Corporation (CDM) files unless the client requests that it be transferred to them for use in legal proceedings or at the completion of the contract.

Note: Sample custody documentation requirements vary with the specific EPA region or client. This SOP is intended to present basic sample custody requirements, along with common options. Specific sample custody requirements should be presented in the project-specific quality assurance (QA) project plan or project-specific modification or clarification form (see Section U-1).

2.0 Background

2.1 Definitions

Sample - A sample is material to be analyzed that is contained in single or multiple containers representing a unique sample identification number.

Sample Custody - A sample is under custody if:

1. It is in your possession
2. It is in your view, after being in your possession
3. It was in your possession and you locked it up
4. It is in a designated secure area

Chain-of-Custody Record - A chain-of-custody record is a form used to document the transfer of custody of samples from one individual to another.

Custody Seal - A custody seal is a tape-like seal that is part of the chain-of-custody process and is used to detect tampering with samples after they have been packed for shipping.

Sample Label - A sample label is an adhesive label placed on sample containers to designate a sample identification number and other sampling information.

Sample Tag - A sample tag is attached with string to a sample container to designate a sample identification number and other sampling information. Tags may be used when it is difficult to physically place adhesive labels on the container (e.g., in the case of small air sampling tubes).

3.0 Responsibilities

Sampler - The sampler is personally responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

Field Team Leader - The field team leader (FTL) is responsible for ensuring that strict chain-of-custody procedures are maintained during all sampling events. The FTL is also responsible for coordinating with the subcontractor laboratory to ensure that adequate information is recorded on custody records. The FTL determines whether proper custody procedures were followed during the fieldwork and decides if additional samples are required.

Field Sample Custodian - The field sample custodian, when designated by the FTL, is responsible for accepting custody of samples from the sampler(s) and properly packing and shipping the samples to the laboratory assigned to do the analyses. A field sample custodian is typically designated only for large and complex field efforts.

4.0 Required Supplies

- Chain-of-custody records (applicable client or CDM forms)
- Sample labels or tags
- Custody seals
- Clear tape

5.0 Procedures

5.1 Chain-of-Custody Record

This procedure establishes a method for maintaining custody of samples through use of a chain-of-custody record. This procedure will be followed for all samples collected or split samples accepted.

Field Custody

1. Collect only the number of samples needed to represent the media being sampled. To the extent possible, determine the quantity and types of samples and sample locations prior to the actual fieldwork. As few people as possible should handle samples.

2. Complete sample labels or tags for each sample using waterproof ink.

3. Maintain personal custody of the samples (in your possession) at all times until custody is transferred for sample shipment or directly to the analytical laboratory.

Transfer of Custody and Shipment

1. Complete a chain-of-custody record for all samples (see Figure 1 for an example of a chain-of-custody record. Similar forms may be used when requested by the client). When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents sample custody transfer from the sampler, often through another person, to the sample custodian in the appropriate laboratory.

    - The date/time will be the same for both signatures when custody is transferred directly to another person. When samples are shipped via common carrier (e.g., Federal Express), the

date/time will not be the same for both signatures. Common carriers are not required to sign the chain-of-custody record.

- In all cases, it must be readily apparent that the person who received custody is the same person who relinquished custody to the next custodian.
- If samples are left unattended or a person refuses to sign, this must be documented and explained on the chain-of-custody record.

Note: If a field sample custodian has been designated, he/she may initiate the chain-of-custody record, sign, and date as the relinquisher. The individual sampler(s) must sign in the appropriate block, but does (do) not need to sign and date as a relinquisher (refer to Figure 1).

2. Package samples properly for shipment and dispatch to the appropriate laboratory for analysis. Each shipment must be accompanied by a separate chain-of-custody record. If a shipment consists of multiple coolers, samples in the coolers may be recorded on a single chain-of-custody record.

3. The original record will accompany the shipment, and the copies will be retained by the FTL and, if applicable, distributed to the appropriate sample coordinators. Freight bills will also be retained by the FTL as part of the permanent documentation. The shipping number from the freight bill shall be recorded on the applicable chain-of-custody record.

Procedure for Completing CDM Example Chain-of-Custody Record
The following procedure is to be used to fill out the CDM chain-of-custody record. The record provided herein (Figure 1) is an example chain-of-custody record. If another type of custody record (i.e., provided by the EPA contract laboratory program or a subcontract laboratory) is used to track the custody of samples, the custody record should be filled out in its entirety.

1. Record project number.
2. Record FTL for the project (if a field sample custodian has been designated, also record this name in the "Remarks" box).
3. Record the name and address of the laboratory to which samples are being shipped.
4. Enter the project name/location or code number.
5. Record overnight courier's airbill number.
6. Record sample location number.
7. Record sample number.
8. Note preservatives added to the sample.
9. Note media type (matrix) of the sample.
10. Note sample type (grab or composite).
11. Enter date of sample collection.
12. Enter time of sample collection in military time.

Figure 1
Example CDM Chain-of-Custody Record

CDM

125 Maiden Lane, 5th Floor
New York, NY 10038
(212) 785-9123
Fax: (212) 785-6114

CHAIN OF CUSTODY RECORD

PROJECT ID.	FIELD TEAM LEADER	LABORATORY AND ADDRESS	DATE SHIPPED
PROJECT NAME/LOCATION		LAB CONTRACT:	AIRBILL NO.

MEDIA TYPE
1. Surface Water
2. Groundwater
3. Leachate
4. Field QC
5. Soil/Sediment
6. Oil
7. Waste
8. Other _____

PRESERVATIVES
1. HCl, pH <2
2. HNO3, pH <2
3. NaOH, pH >12
4. H2SO4, pH <2
5. Zinc Acetate, pH >9
6. Ice Only
7. Not Preserved
8. Other _____

SAMPLE TYPE
G = Grab
C = Composite

SAMPLE LOCATION NO.	LABORATORY SAMPLE NUMBER	PRESERVATIVES ADDED	MEDIA TYPE	SAMPLE TYPE	20__ DATE	TIME SAMPLED	ANALYSES (List no. of containers submitted)								REMARKS (Note if MS/MSD)
1.															
2.															
3.															
4.															
5.															
6.															
7.															
8.															
9.															
10.															

SAMPLER SIGNATURES:

RELINQUISHED BY: (PRINT)	DATE/TIME	RECEIVED BY: (PRINT)	DATE/TIME	RELINQUISHED BY: (PRINT)	DATE/TIME	RECEIVED BY: (PRINT)	DATE/TIME
(SIGN)		(SIGN)		(SIGN)		(SIGN)	
RELINQUISHED BY: (PRINT)	DATE/TIME	RECEIVED BY: (PRINT)	DATE/TIME	RELINQUISHED BY: (PRINT)	DATE/TIME	RECEIVED BY: (PRINT)	DATE/TIME
(SIGN)		(SIGN)		(SIGN)		(SIGN)	

COMMENTS:

DISTRIBUTION: White and yellow copies accompany sample shipment to laboratory; yellow copy retained by laboratory; Pink copy retained by samplers. 1/98

Note: If requested by the client, different chain-of-custody records may be used. Copies of the template for this record may be obtained from the Chantilly Graphics Department.

13. When required by the client, enter the names or initials of the samplers next to the sample location number of the sample they collected.
14. List parameters for analysis and the number of containers submitted for each analysis.
15. Enter matrix spike/matrix spike duplicate (MS/MSD) if sample is for **laboratory** quality control or other remarks (e.g., sample depth).
16. Sign the chain-of-custody record(s) in the space provided. All samplers must sign each record.
17. If sample tags are used, record the sample tag number in the "Remarks" column.
18. The originator checks information entered in Items 1 through 16 and then signs the top left "Relinquished by" box, prints his/her name, and enters the current date and time (military).
19. Send the top two copies (usually white and yellow) with the samples to the laboratory; retain the third copy (usually pink) for the project files. Retain additional copies for the project file or distribute as required to the appropriate sample coordinators.
20. The laboratory sample custodian receiving the sample shipment checks the sample label information against the chain-of-custody record. Sample condition is checked and anything unusual is noted under "Remarks" on the chain-of-custody record. The laboratory custodian receiving custody signs in the adjacent "Received by" box and keeps the copy. The white copy is returned to CDM.

5.2 Sample Labels and Tags

Unless the client directs otherwise, sample labels or tags will be used for all samples collected or accepted for CDM projects.

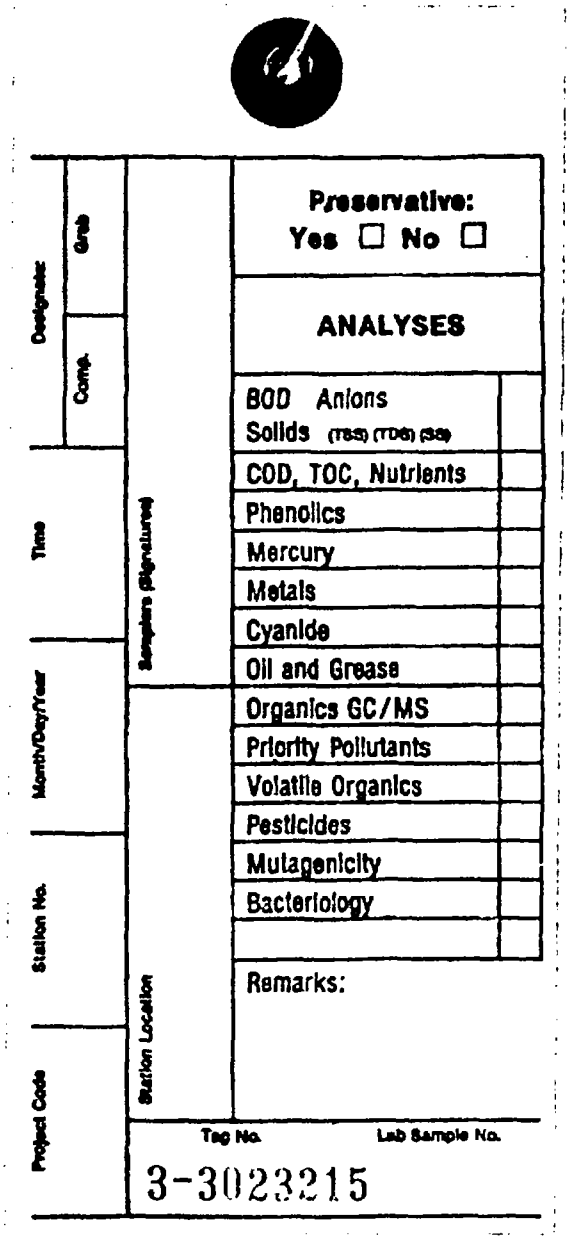
1. Complete one label or tag with the information required by the client for each sample container collected. A typical label or tag would be completed as follows (see Figure 2 for example of sample tag; labels are completed with the equivalent information):

   - Record the project code (i.e., project or task number).
   - Enter the station number (sample number) if applicable.
   - Record the date to indicate the month, day, and year of sample collection.
   - Enter the time (military) of sample collection.
   - Place a check to indicate composite or grab sample.
   - Record the station (sample) location.
   - Sign in the space provided.
   - Place a check next to "yes" or "no" to indicate if a preservative was added.
   - Place a check under "Analyses" next to the parameters for which the sample is to be analyzed. If the desired analysis is not listed, write it in the empty slot. **Note**: Do not write in the box for "laboratory sample number."
   - Place or write additional relevant information under "Remarks."

2. Place adhesive labels directly on the sample containers. Place clear tape over the label to protect from moisture.

3. Securely attach sample tags to the sample bottle. On 2.27 liter (80 oz.) amber bottles, the tag string may be looped through the ring style handle and tied. On all other containers, it is

Figure 2
Example Sample Tag



Note: Equivalent sample labels or tags may be used.

recommended that the string be looped around the neck of the bottle, then twisted and re-looped around the neck until the slack in the string is removed.

4. Double-check that the information recorded on the sample tag is consistent with the information recorded on the chain-of-custody record.

5.3 Custody Seals

Two custody seals must be placed on opposite corners of all shipping containers (e.g., cooler) prior to shipment. The seals should be signed and dated by the shipper.

Custody seals may also be placed on individual sample bottles. Check with the client or refer to EPA regional guidelines for direction.

5.4 Sample Shipping

The CDM standard operating procedure listed below defines the requirements for packaging and shipping environmental samples.

- CDM Federal SOP 2-1, Packaging and Shipping Environmental Samples

6.0 Restrictions/Limitations

Check with the EPA region or client for specific guidelines. If no specific guidelines are identified, this procedure should be followed.

For EPA Contract Laboratory Program (CLP) sampling events, combined chain-of-custody/traffic report forms or other EPA-specific records may be used. Refer to regional guidelines for completing these forms.

The EPA FORMS II Lite™ software may be used to customize sample labels and custody records when directed by the client or the CDM project manager.

7.0 References

U.S. Environmental Protection Agency, *EPA Guidance for Quality Assurance Project Plans*, EPA QA/G-5, EPA/600/R-98/018, February 1998, Section B3.

U.S. Environmental Protection Agency, *National Enforcement Investigations Center, Multi-Media Investigation Manual*, EPA-330/9-89-003-R, Revised March 1992, p.85.

U.S. Environmental Protection Agency, *Contract Laboratory Program (CLP), Guidance for Field Samplers*, EPA-540-R-00-003, Draft Final, June 2001, Section 3.2.

U.S. Environmental Protection Agency, *FORMS II Lite™ User's Guide*, March 2001.

U.S. Environmental Protection Agency, Region IV, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, May 1996, Section 3.3.

U.S. Army Corps of Engineers, *Requirements for the Preparation of Sampling and Analysis Plan*, EM 200-1-3, February 2001, Appendix F.

Project-Specific Modification

OP No.: 2-1

OP Title: Packaging and Shipping of Environmental Samples

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Procedures for shipping environmental samples for the Libby asbestos project vary slightly from CDM Technical SOP 2-1. These modifications are necessary for the entire duration of the project.

Samples collected during this investigation will be packaged and shipped in accordance with CDM Technical SOP 2-1, with the following modifications:

Section 1.4, Required Equipment - Vermiculite (or other absorbent material), bubble wrap, or ice will not be used for packaging or shipping samples.

Section 1.5, Procedures - No vermiculite or other absorbent material will be used to pack the samples. No ice will be used.

Packaging and Shipping Environmental Samples

SOP: 2-1
Revision: 2
Date: March 1, 2004

Prepared: Krista Lippoldt
Technical Review: Chuck Myers
QA Review: Douglas J. Updike
Approved: Michael C. Molloy 2/24/04
Signature/Date
Issued: 2/18/04
Signature/Date

1.0 Packaging and Shipping of All Samples

This standard operating procedure (SOP) applies to the packaging and shipping of all environmental samples. If the sample is preserved or radioactive, the following sections may also be applicable.

Section 2.0 - Packaging and Shipping Samples Preserved with Methanol
Section 3.0 - Packaging and Shipping Samples Preserved with Sodium Hydroxide
Section 4.0 - Packaging and Shipping Samples Preserved with Hydrochloric Acid
Section 5.0 - Packaging and Shipping Samples Preserved with Nitric Acid
Section 6.0 - Packaging and Shipping Samples Preserved with Sulfuric Acid
Section 7.0 - Packaging and Shipping Limited-Quantity Radioactive Samples

1.1 Objective

The objective of this SOP is to outline the requirements for the packaging and shipment of environmental samples. Additionally, Sections 2.0 through 7.0 outline requirements for the packaging and shipping of regulated environmental samples under the Department of Transportation (DOT) Hazardous Materials Regulations, the International Air Transportation Association (IATA), and International Civil Aviation Organization (ICAO) Dangerous Goods Regulations for shipment by air and applies only to domestic shipments. This SOP does not cover the requirements for packaging and shipment of equipment (including data loggers and self-contained breathing apparatus [SCBAs] or bulk chemicals that are regulated under the DOT, IATA, and ICAO.

1.2 Background

1.2.1 Definitions

Environmental Sample - An aliquot of air, water, plant material, sediment, or soil that represents the contaminant levels on a site. Samples of potential contaminant sources, like tanks, lagoons, or non-aqueous phase liquids are normally not "environmental" for this purpose. This procedure applies only to environmental samples that contain less than reportable quantities for any foreseeable hazardous constituents according to DOT regulations promulgated in 49 CFR - Part 172.101 Appendix A.

Custody Seal - A custody seal is a narrow adhesive-backed seal that is applied to individual sample containers and/or the container (i.e., cooler) before offsite shipment. Custody seals are used to demonstrate that sample integrity has not been compromised during transportation from the field to the analytical laboratory.

Inside Container - The container, normally made of glass or plastic, that actually contacts the shipped material. Its purpose is to keep the sample from mixing with the ambient environment.

Outside Container - The container, normally made of metal or plastic, that the transporter contacts. Its purpose is to protect the inside container.

Secondary Containment - The outside container provides secondary containment if the inside container breaks (i.e., plastic overpackaging if liquid sample is collected in glass).

Excepted Quantity - Excepted quantities are limits to the mass or volume of a hazardous material in the inside and outside containers below which DOT, IATA, ICAO regulations do not apply. The excepted quantity limits are very low. Most regulated shipments will be made under limited quantity.

Limited Quantity - Limited quantity is the maximum amount of a hazardous material below which there are specific labeling or packaging exceptions.

Performance Testing - Performance testing is the required testing of outer packaging. These tests include drop and stacking tests.

Qualified Shipper - A qualified shipper is a person who has been adequately trained to perform the functions of shipping hazardous materials.

1.2.2 Discussion

Proper packaging and shipping is necessary to ensure the protection of the integrity of environmental samples shipped for analysis. These shipments are potentially subject to regulations published by DOT, IATA, or ICAO. Failure to abide by these rules places both CDM and the individual employee at risk of serious fines. The analytical holding times for the samples must not be exceeded. The samples should be packed in time to be shipped for overnight delivery. Make arrangements with the laboratory before sending samples for weekend delivery.

1.2.3 Associated Procedure

- CDM Federal SOP 1-2, Sample Custody

1.3 Required Equipment

- Coolers with return address of the appropriate CDM office
- Heavy-duty plastic garbage bags
- Plastic zip-type bags, small and large
- Clear tape
- Nylon reinforced strapping tape
- Duct tape
- Vermiculite (or an equivalent nonflammable material that is inert and absorbent)*
- Bubble wrap (optional)
- Ice
- Custody seals
- Completed chain-of-custody record or contract laboratory program (CLP) custody records, if applicable
- Completed bill of lading
- "This End Up" and directional arrow labels

* Check for any client-specific or laboratory requirements related to the use of absorbent packaging materials.

1.4 Packaging Environmental Samples

The following steps must be followed when packing sample bottles and jars for shipment:

1. Verify the samples undergoing shipment meet the definition of "environmental sample" and are not a hazardous material as defined by DOT. Professional judgment and/or consultation with qualified persons such as the appropriate health and safety coordinator or the health and safety manager should be observed.

2. Select a sturdy cooler in good repair. Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler. Line the cooler with a large heavy-duty plastic garbage bag.

3. Be sure the caps on all bottles are tight (will not leak); check to see that labels and chain-of-custody records are completed properly (SOP 1-2, Sample Custody).

4. Place all bottles in separate and appropriately sized plastic zip-top bags and close the bags. Up to three VOA vials may be packed in one bag. Binding the vials together with a rubber band on the outside of the bag, or separating them so that they do not contact each other, will reduce the risk of breakage. Bottles may be wrapped in bubble wrap. Optionally, place three to six VOA vials in a quart metal can and then fill the can with vermiculite or equivalent. **Note**: Trip blanks must be included in coolers containing VOA samples.

5. Place 2 to 4 inches of vermiculite (or equivalent) into a cooler that has been lined with a garbage bag, and then place the bottles and cans in the bag with sufficient space to allow for the addition of packing material between the bottles and cans. It is preferable to place glass sample bottles and jars into the cooler vertically. Glass containers are less likely to break when packed vertically rather than horizontally.

6. While placing sample containers into the cooler, conduct an inventory of the contents of the shipping cooler against the chain-of-custody record. The chain-of-custody with the cooler should reflect only those samples within the cooler.

7. Put ice in large plastic zip-top bags (double bagging the zip-tops is preferred) and properly seal. Place the ice bags on top of and/or between the samples. Several bags of ice are required (dependant on outdoor temperature, staging time, etc.) to maintain the cooler temperature at approximately 4° Celsius (C) if the analytical method requires cooling. Fill all remaining space between the bottles or cans with packing material. Securely fasten the top of the large garbage bag with fiber or duct tape.

8. Place the completed chain-of-custody record or the CLP traffic report form (if applicable) for the laboratory into a plastic zip-top bag, seal the bag, tape the bag to the inner side of the cooler lid and close the cooler.

9. The cooler lid shall be secured with nylon reinforced strapping tape by wrapping each end of the cooler a minimum of two times. Attach a completed chain-of-custody seal across the opening of the cooler on opposite sides. The custody seals should be affixed to the cooler with half of the seal on the strapping tape so that the cooler cannot be opened without breaking the seal. Complete two more wraps around with fiber tape and place clear tape over the custody seals.

10. The shipping container lid must be marked **"THIS END UP"** and arrow labels that indicate the proper upward position of the container should be affixed to the cooler. A label containing the name and address of the shipper (CDM) shall be placed on the outside of the container. Labels used in the shipment of hazardous materials (such as Cargo Only Air Craft, Flammable Solids, etc.) are not permitted on the outside of containers used to transport environmental samples and shall not be used. The name and address of the laboratory shall be placed on the container, or when shipping by common courier, the bill of lading shall be completed and attached to the lid of the shipping container.

2.0 Packaging and Shipping Samples Preserved with Methanol

2.1 Containers

- The maximum volume of methanol in a sample container is limited to 30 ml.
- The sample container must not be full of methanol.

2.2 Responsibility

It is the responsibility of the qualified shipper to:

- Ensure that the samples undergoing shipment contain no other contaminant that meets the definition of "hazardous material" as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

2.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Inner packing may consist of glass or plastic jars
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Survey documentation (if shipping from Department of Energy [DOE] or radiological sites)
- Class 3 flammable liquid labels
- Orientation labels
- Consignor/consignee labels

2.4 Packaging Samples Preserved with Methanol

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.

- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each container (40-ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (Maximum of 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)
- Total volume of methanol per shipping container must not exceed 500 ml.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

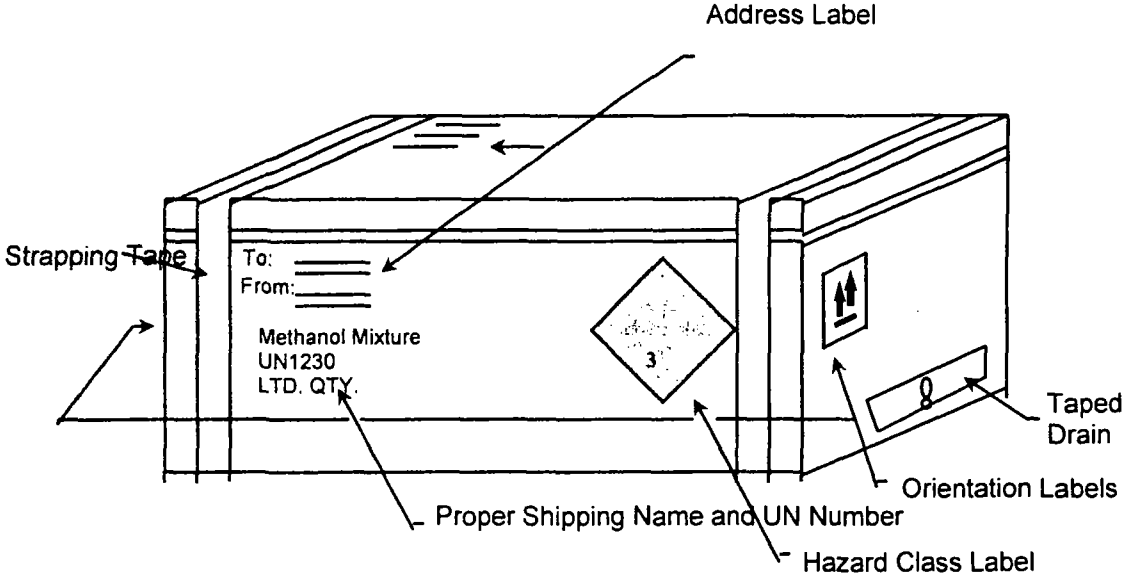
  Methanol Mixture
  UN1230
  LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Flammable Liquid label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: No marking or labeling can be obscured by strapping or duct tape.
Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- *When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.*
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

Figure 1 - Example of Cooler Label/Marking Locations



3.0 Packaging and Shipping Samples Preserved with Sodium Hydroxide

3.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Sodium Hydroxide Preservatives

Preservative		Desired in Final Sample		Quantity of Preservative (ml) for Specified Container				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
NaOH	30%	>12	0.08%		.25	0.5	1	2

5 drops = 1 ml

3.2 Responsibility

It is the responsibility of the qualified shipper to determine the amount of preservative in each sample so that accurate determination of quantities can be made.

3.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3:

- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test
- Inner packings may consist of glass or plastic jars no larger than 1 pint
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

3.4 Packaging Samples Preserved with Sodium Hydroxide

Samples containing NaOH as a preservative that exceed the excepted concentration of 0.08 percent (2 ml of a 30 percent NaOH solution per liter) may be shipped as a limited quantity per packing instruction Y819 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- The total volume of sample in each cooler must not exceed 1 liter.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.

- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Sodium Hydroxide Solution
UN1824
LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples meeting the exception concentration of 0.08 percent NaOH by weight may be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

4.0 Packaging and Shipping Samples Preserved with Hydrochloric Acid

4.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Hydrochloric Acid Preservatives

Preservative		Desired In Final Sample		Quantity of Preservative (ml) for Specified Container		
		pH	Conc.	40 ml	125 ml	250 ml
HCl	2N	<1.96	0.04%	.2	.5	1

5 drops = 1 ml

4.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

4.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packing may consist of glass or plastic jars no larger than 1 pint.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

4.4 Packaging Samples Preserved with Hydrochloric Acid

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each container (40-ml VOA vials) in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place wrapped containers inside a polyethylene bottle filled with vermiculite; seal the bottle. (No more than 4 VOA vials will fit inside a 500-ml wide-mouth polyethylene bottle.)

- Total volume of sample inside each cooler must not exceed 1 liter.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

  Hydrochloric Acid Solution
  UN1789
  LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

  Note: Samples containing less than the exception concentration of 0.04 percent HCl by weight will be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

  Note: No marking or labeling can be obscured by strapping or duct tape.

  Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.

- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

5.0 Packaging and Shipping Samples Preserved with Nitric Acid

5.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Nitric Acid Preservatives

Preservative		*Desired in Final Sample*		*Quantity of Preservative (ml) for Specified Container*				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
HNO_3	6N	<1.62	0.15%		2	4	5	8

5 drops = 1 ml

5.2 Responsibility

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

5.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packings may consist of glass or plastic jars no larger than 100 ml.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- Survey documentation (if shipping from DOE or radiological sites)
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

5.4 Packaging Samples Preserved with Nitric Acid

Samples containing HNO_3 as a preservative that exceed the excepted concentration of 0.15 percent HNO_3 will be shipped as a limited quantity per packing instruction Y807 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity sample shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name

  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody)
- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum volume of preserved solution in the cooler must not exceed 500 ml.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Nitric Acid Solution (with less than 20 percent)
UN2031
Ltd. Qty.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples meeting the exception concentration of 0.15 percent HNO_3 by weight will be shipped as non-regulated or non-hazardous following the procedure in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

6.0 Packaging and Shipping Samples Preserved with Sulfuric Acid

6.1 Containers

The inner packaging container (and amount of preservative) that may be used for these shipments includes:

Excepted Quantities of Sulfuric Acid Preservatives

Preservative		Desired in Final Sample		Quantity of Preservative (ml) for Specified Container				
		pH	Conc.	40 ml	125 ml	250 ml	500 ml	1 L
H_2SO_4	37N	<1.15	0.35%	.1	.25	0.5	1	2

5 drops = 1 ml

6.2 *Responsibility*

It is the responsibility of the qualified shipper to:

- Determine the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT
- Determine the amount of preservative in each sample so that accurate determination of quantities can be made

6.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Inner packings may consist of glass or plastic jars no larger than 100 ml.
- Outer packaging (for limited quantities) insulated cooler that has passed the ICAO drop test.
- *Survey documentation (if shipping from DOE or radiological sites)*
- Class 8 corrosive labels
- Orientation labels
- Consignor/consignee labels

6.4 Packaging of Samples Preserved with Sulfuric Acid

Samples containing H_2SO_4 as a preservative that exceed the excepted concentration of 0.35 percent will be shipped as a limited quantity per packing instruction Y809 of the IATA/ICAO Dangerous Goods Regulations.

The following steps are to be followed when packaging limited-quantity samples shipments.

- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number
  - Date and time of sample collection
  - Sample location
  - Sample identification number
  - Collector's initials
  - Preservative (note amount of preservative used in miscellaneous section of the chain-of-custody form)
- Wrap each glass container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place the bubble-wrapped container into a 2.7-mil zip-type bag, removing trapped air.
- Place glass containers inside a polyethylene bottle filled with vermiculite; seal the bottle.
- Place sufficient amount of vermiculite in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- Place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- The maximum volume of preserved solution in the cooler must not exceed 500 ml.
- The maximum weight of the cooler shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- Wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Mark the outside of the cooler with the proper shipping name of the contents, corresponding UN number, and LTD. QTY. (as shown below).

Sulfuric Acid Solution
UN2796
LTD. QTY.

- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix a Corrosive label to the outside of the cooler.
- Affix package orientation labels on two opposite sides of the cooler.
- Secure the marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of cooler labeling/marking locations is shown in Figure 1.

Note: Samples containing less than the exception concentration of 0.35 percent H_2SO_4 by weight will be shipped as non-regulated or non-hazardous in accordance with the procedure described in Section 1.4.

Note: No marking or labeling can be obscured by strapping or duct tape.

Note: The inner packaging of dangerous goods must be placed into the designated cooler for shipment. Other non-regulated environmental samples may be added to the cooler for shipment.

- When shipping from a DOE facility, the cooler will be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Complete the Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity (Appendix A).
- Complete a Dangerous Goods Airbill.

7.0 Packaging and Shipping Limited-Quantity Radioactive Samples

7.1 Containers

The inner packaging containers that may be used for these shipments include:

- Any size sample container

7.2 Description/Responsibilities

- The qualified shipper will determine that the samples undergoing shipment contain no other contaminant that meets the definition of hazardous material as defined by DOT.
- The qualified shipper will ship all samples that meet the Class 7 definition of radioactive materials and meet the activity requirements specified in Table 7 of 49 CFR 173.425, as *Radioactive Materials in Limited Quantity*. The qualified shipper will verify that all packages and their contents meet the requirements of 49 CFR 173.421, *Limited Quantities of Radioactive Materials*.
- The packaging used for shipping will meet the general requirements for packaging and packages specified in 49 CFR 173.24 and the general design requirements provided in 173.410. These standards state that a package must be capable of withstanding the effects of any acceleration, vibration, or vibration resonance that may arise under normal condition of transport without any deterioration in the effectiveness of the closing devices on the various

receptacles or in the integrity of the package as a whole and without loosening or unintentionally releasing the nuts, bolts, or other securing devices even after repeated use.

- If the shipment is from a DOE facility, radiological screenings will be completed on all samples taken. The qualified shipper will review the results of each screening (alpha, beta, and gamma speciation). Samples will not be shipped offsite until the radiological screening has been performed.
- The total activity for each package will not exceed the relevant limits listed in Table 7 of 49 CFR 173.425. The A_2 value of the material will be calculated based on all radionuclides found during previous investigations (if any) in the area from which the samples are derived. The A_2 values to be used will be the most restrictive of all potential radionuclides as listed in 49 CFR 173.435.
- The radiation level at any point on the external surface of the package bearing the sample(s) will not exceed 0.005 mSv/hour (0.5 mrem/hour). These will be verified by dose and activity monitoring prior to shipment of the package.
- The removable radioactive surface contamination on the external surface of the package will not exceed the limits specified in 49 CFR 173.443(a). CDM will apply the DOE-established free release criteria for removable surface contamination of less than 20 dpm/100 cm^2 (alpha) and 1,000 dpm/100 cm^2 (beta/gamma). It should be noted that these values are more conservative than the DOT requirements for removable surface contamination.
- The qualified shipper will verify that the outside of the inner packaging is marked "Radioactive."
- The qualified shipper will verify that the excepted packages prepared for shipment under the provisions of 49 CFR 173.421 have a notice enclosed, or shown on the outside of the package, that reads, **"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910."**

7.3 Additional Required Equipment

The following equipment is needed in addition to the required equipment listed in Section 1.3.

- Survey documentation/radiation screening results (if shipping from DOE or radiological sites)
- Orientation labels
- Excepted quantities label
- Consignor/consignee labels

7.4 Packaging of Limited-Quantity Radioactive Samples

The following steps are to be followed when packaging limited-quantity sample shipments.

- The cooler is to be surveyed by a qualified radiation control technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/h on all sides. This survey will be documented and the results reviewed by the qualified shipper.
- Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler.
- All sample containers will be properly labeled and the label protected with waterproof tape prior to sampling.
- At a minimum the label must contain:
  - Project name
  - Project number

- Date and time of sample collection
- Sample location
- Sample identification number
- Collector's initials

- This step is optional; wrap each container in bubble wrap (secure with waterproof tape) to prevent breakage.
- Place sufficient amount of vermiculite, or approved packaging material, in the bottom of the cooler to absorb any leakage that may occur.
- Place a garbage bag in the cooler.
- Pack the samples appropriately inside the garbage bag (bottles placed upright) to prevent movement during shipment.
- If required, place a sufficient amount of double-bagged ice around the samples to maintain the required temperature during shipment.
- Seal the garbage bag by tieing or taping.
- Place a label marked Radioactive on the outside of the sealed bag.
- Enclose a notice that includes the name of the consignor or consignee and the following statement: **"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910."**
- Note that both DOT and IATA apply different limits to the quantity in the inside packing and in the outside packing.
- The maximum weight of the package shall not exceed 30 kg (66 lbs) for any limited-quantity shipment of dangerous goods.
- Secure the chain-of-custody form (placed inside a zip-type bag) to the interior of the cooler lid.
- If the shipment is from a DOE or other facility, place the results of the radiation screen and cooler/sample survey with the chain-of-custody.
- If a cooler is used, wrap strapping tape or duct tape around both ends of the cooler and around the cooler lid.
- Affix custody seals to opposite sides of the cooler lid. Cover the custody seals with clear waterproof tape.
- Place a label on the front of the cooler with the company name, contact name, phone number, full street address, and state with zip code for both shipper and recipient.
- Affix package orientation labels on two opposite sides of the cooler/package.
- Affix a completed Excepted Quantities label to the side of the cooler/package.
- Secure any marking and labels to the surface of the cooler with clear waterproof tape to prevent accidental removal during shipment.
- An example of the cooler labeling/marking is shown in Figure 2.

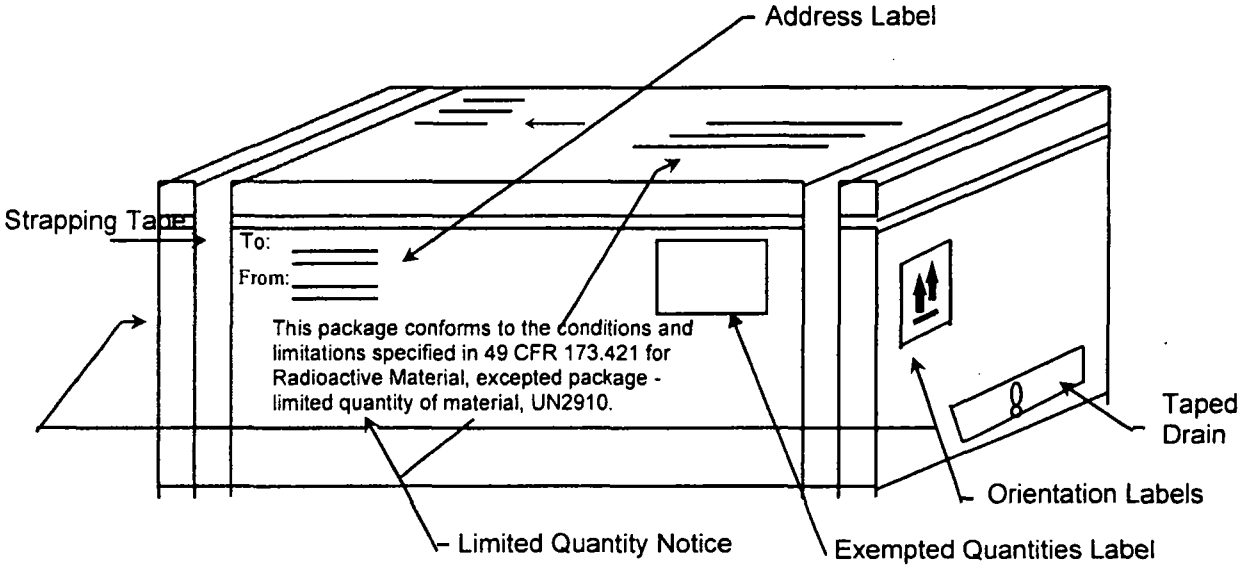
  Note: No marking or labeling can be obscured by strapping or duct tape.

- Complete the Shipment Quality Assurance Checklist (Appendix B).

  Note: Except as provided in 49 CFR 173.426, the package will not contain more than 15 grams of ^{235}U.

  Note: A declaration of dangerous goods is not required.

Figure 2 - Radioactive Material – Limited-Quantity Cooler Marking Example



8.0 References

U.S. Environmental Protection Agency, *Sampler's Guide to the Contract Laboratory Program*, EPA/540/P-90/006, December 1990.

U.S. Environmental Protection Agency, Region IV, *Standard Operating Procedures and Quality Assurance Manual*, February 1991.

U.S. Environmental Protection Agency Rule, 40 CFR 136.

Appendix A

Dangerous Goods and Hazardous Materials Inspection Checklist for Shipping Limited-Quantity

Sample Packaging

Yes	No	N/A	
❑	❑	❑	The VOA vials are wrapped in bubble wrap and placed inside a zip-type bag.
❑	❑	❑	The VOA vials are placed into a polyethylene bottle, filled with vermiculite, and tightly sealed.
❑	❑	❑	The drain plug is taped inside and outside to ensure control of interior contents.
❑	❑	❑	The samples have been placed inside garbage bags with sufficient bags of ice to preserve samples at 4°C.
❑	❑	❑	The cooler weighs less than the 66-pound limit for limited-quantity shipment.
❑	❑	❑	The garbage bag has been sealed with tape (or tied) to prevent movement during shipment.
❑	❑	❑	The chain-of-custody has been secured to the interior of the cooler lid.
❑	❑	❑	The cooler lid and sides have been taped to ensure a seal.
❑	❑	❑	The custody seals have been placed on both the front and back hinges of the cooler, using waterproof tape.

Air Waybill Completion

Yes	No	N/A	
❑	❑	❑	Section 1 has the shipper's name, company, and address; the account number, date, internal billing reference number; and the telephone number where the shipper can be reached.
❑	❑	❑	Section 2 has the recipient's name and company along with a telephone number where they can be reached.
❑	❑	❑	Section 3 has the **Bill Sender** box checked.
❑	❑	❑	Section 4 has the **Standard Overnight** box checked.
❑	❑	❑	Section 5 has the **Deliver Weekday** box checked.
❑	❑	❑	Section 6 has the number of packages and their weights filled out. Was the total of all packages and their weights figured up and added at the bottom of Section 6?
❑	❑	❑	Under the **Transport Details** box, the **Cargo Aircraft Only** box is obliterated, leaving only the **Passenger and Cargo Aircraft** box.
❑	❑	❑	Under the **Shipment Type**, the **Radioactive** box is obliterated, leaving only the **Non-Radioactive** box.
❑	❑	❑	Under the **Nature and Quantity of Dangerous Goods** box, the **Proper Shipping Name, Class or Division, UN or ID No., Packing Group, Subsidiary Risk, Quantity and Type of Packing, Packing Instructions, and Authorization** have been filled out for the type of chemical being sent.
❑	❑	❑	The **Name, Place and Date, Signature, and Emergency Telephone Number** appears at the bottom of the FedEx Airbill.
❑	❑	❑	The statement "In accordance with IATA/ICAO" appears in the **Additional Handling Information** box.
❑	❑	❑	The **Emergency Contact Information** at the bottom of the FedEx Airbill is truly someone who can respond any time of the day or night.

Proper Shipping Name	Class or Division	UN or ID No.	Packing Group	Sub Risk	Quantity	Packing Instruction	Authorization
Hydrochloric Acid Solution	8	UN1789	II		1 plastic box × 0.5 L	Y809	Ltd. Qty.
Nitric Acid Solution (with less than 20%)	8	UN2031	II		1 plastic box × 0.5 L	Y807	Ltd. Qty.
Sodium Hydroxide Solution	8	UN1824	II		1 plastic box × 0.5 L	Y809	Ltd. Qty.
Sulfuric Acid Solution	8	UN2796	II		1 plastic box × 0.5 L	Y809	Ltd. Qty.
Methanol	3	UN1230	II		1 plastic box × 1 L	Y305	Ltd. Qty.

Sample Cooler Labeling

Yes	No	N/A	
❑	❑	❑	The proper shipping name, UN number, and Ltd. Qty. appears on the shipping container.
❑	❑	❑	The corresponding hazard labels are affixed on the shipping container; the labels are not obscured by tape.
❑	❑	❑	The name and address of the shipper and receiver appear on the top and side of the shipping container.
❑	❑	❑	The air waybill is attached to the top of the shipping container.
❑	❑	❑	**Up Arrows** have been attached to opposite sides of the shipping container.
❑	❑	❑	Packaging tape does not obscure markings or labeling.

Appendix B
Shipment Quality Assurance Checklist

Date: _____ Shipper: _____ Destination: _____

Item(s) Description: _____

Radionuclide(s): _____

Radiological Survey Results: surface _____mrem/hr 1 meter _____

Instrument Used: Mfgr: _____ Model: _____

S/N: _____ Cal Date: _____

Limited-Quantity or Instrument and Article

Yes	No		
___	___	1.	Strong tight package (package that will not leak material during conditions normally incidental to transportation).
___	___	2.	Radiation levels at any point on the external surface of package less than or equal to 0.5 mrem/hr.
___	___	3.	Removable surface contamination less than 20 dpm/100 cm^2 (alpha) and 1,000 dpm/100 cm^2 (beta/gamma).
___	___	4.	Outside inner package bears the marking "Radioactive."
___	___	5.	Package contains less than 15 grams of ^{235}U (check yes if ^{235}U not present).
___	___	6.	Notice enclosed in or on the package that includes the consignor or consignee and the statement, **"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910."**
___	___	7.	Activity less than that specified in 49 CFR 173.425. Permissible package limit: Package Quantity:
___	___	8.	On all air shipments, the statement **Radioactive Material, excepted package-limited quantity of material** shall be noted on the air waybill.

Qualified Shipper: _____ Signature: _____

Project Specific Modification

SOP No.: 2-2

SOP Title: Guide to Handling Investigation-Derived Waste

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures for disposing of Libby amphibole asbestos contaminated IDW are different than CDM Technical SOP 2-2. These modifications are necessary for the entire duration of the project.

All IDW will be handled in accordance with CDM Technical SOP 2-2, Guide to Handling Investigation-Derived Waste, with the following modifications:

Section 5.2, Off Site Disposal - All IDW (not including excess soil volume) will be collected in transparent garbage bags and marked "IDW" with an indelible marker. These bags will be deposited into the asbestos contaminated waste stream for deposal at the mine.

Guide To Handling Investigation-Derived Waste

SOP: 2-2
Revision: 4
Date: March 1, 2004
Page 1 of 7

Prepared: Tim Eggert
Technical Review: Sharon Budney
QA Review: Jeniffer Oxford
Approved: Michael C. Molloy 2/24/04
Signature/Date
Issued: 3/10/04
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1.0 Objective

This standard operating procedure (SOP) presents guidance for the management of investigation-derived waste (IDW). The primary objectives for managing IDW during field activities include:

- Leaving the site in no worse condition than existed prior to field activities
- Remove wastes that pose an immediate threat to human health or the environment
- Proper handling of onsite wastes that do not require offsite disposal or extended above-ground containerization
- Complying with federal, state, and facility applicable or relevant and appropriate requirements (ARARs)
- Careful planning and coordination of IDW management options
- Minimizing the quantity of IDW

2.0 Background

2.1 Definitions

Hazardous Waste - Discarded material that is regulated listed waste, or waste that exhibits ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.3 or state regulations.

Investigation-Derived Wastes (IDWs) - Discarded materials resulting from field activities such as sampling, surveying, drilling, excavations, and decontamination processes that, in present form, possess no inherent value or additional usefulness without treatment. Wastes may be solid, liquid, or gaseous, or multiphase materials that may be classified as hazardous or non-hazardous.

Mixed-Waste - Any material that has been classified as hazardous and radioactive.

Radioactive Wastes - Discarded materials that are contaminated with radioactive constituents with specific activities in concentrations greater than the latest regulatory criteria (i.e., 10 CFR 20).

Treatment, Storage, and Disposal Facility (TSDF) - Permitted facilities that accept hazardous waste shipments for further treatment, storage, and/or disposal. These facilities must be permitted by the U.S. Environmental Protection Agency (EPA) and appropriate state agencies.

2.2 Discussion

Field investigation activities result in the generation of waste materials that may be characterized as hazardous or radioactive waste. IDWs may include drilling muds, cuttings, and purge water from test pit and well installation; purge water, soil, and other materials from collection of samples; residues from testing of treatment technologies and pump and treat systems; personal protective equipment (PPE); solutions (aqueous or otherwise) used to decontaminate non-disposable protective clothing and

equipment; and other wastes or supplies used in sampling and testing potentially hazardous or radiologically contaminated material.

Note: The client's representatives may not be aware of all potential contaminants. The management of IDW must comply with applicable regulatory requirements.

3.0 Responsibilities

Site Manager - The site manager is responsible for ensuring that all IDW procedures are conducted in accordance with this SOP. The site manager is also responsible for ensuring that handling of IDW is in accordance with site-specific requirements.

Project Manager - The project manager is responsible for identifying site-specific requirements for the disposal of IDW in accordance with federal, state, and/or facility requirements.

Field Crew Members - Field crew members are responsible for implementing this SOP and communicating any unusual or unplanned condition to the project manager's attention.

4.0 Required Equipment

Equipment required for IDW containment will vary according to site-specific/client requirements. Management decisions concerning the necessary equipment required should consider: containment method, sampling, labeling, maneuvering, and storage (if applicable). Equipment must be onsite and inspected before commencing work.

4.1 IDW Containment Devices

The appropriate containment device (drums, tanks, etc.) will depend on site- or client-specific requirements and the ultimate disposition of the IDW. Typical IDW containment devices can include:

- Plastic sheeting (polyethylene) with a minimum thickness of 20 millimeters
- Department of Transportation (DOT) approved steel containers
- Bulk storage tanks comprised of polyethylene or steel

Containment of IDW should be segregated by waste type (i.e., solid or liquid, corrosive or flammable, etc.) and source location. Volume of the appropriate containment device should be site-specific.

4.2 IDW Container Labeling

A "Waste Container" or "IDW Container" label or indelible marking should be applied to each container. Labeling or marking requirements for onsite IDW not expected to be transported offsite are:

- Labels and markings that contain the following information: project name, generation date, location of waste origin, container identification number, sample number (if applicable), and contents (drill cuttings, purge water, PPE, etc.).
- Each label or marking will be applied to the upper one-third of the container at least twice, on opposite sides.
- Containers that are 5 gallons or less may only require one label or set of markings.
- Labels or markings will be positioned on a smooth part of the container. The label must not be affixed across container bungs, seams, ridges, or dents.

- Labels must be constructed of a weather-resistive material with markings made with a permanent marker or paint pen and capable of enduring the expected weather conditions. If markings are used, the color must be easily distinguishable from the drum color.
- Labels will be secured in a manner to ensure the label remains affixed to the container.

Labeling or marking requirements for IDW expected to be transported offsite must be in accordance with the requirements of 49 CFR 172.

4.3 IDW Container Movement

Staging areas for IDW containers should be predetermined and in accordance with site-specific and/or client requirements. Arrangements should be made prior to field mobilization as to the methods and personnel required to safely transport IDW containers to the staging area. Transportation offsite onto a public roadway is prohibited unless 49 CFR 172 requirements are met.

4.4 IDW Container Storage

Containerized IDW should be staged pending chemical analysis or further onsite treatment. Staging areas and bulk storage procedures are to be determined according to site-specific requirements. Containers are to be stored in such a fashion that the labels can be easily read. A secondary/spill container must be provided as appropriate.

5.0 Procedures

The three general options for managing IDW are (1) collection and onsite disposal, (2) collection for offsite disposal, and (3) collection and interim management. Attachment 1 summarizes media-specific information on generation processes and management options. The option selected should take into account the following factors:

- Type (soil, sludge, liquid, debris), quantity, and source of IDW
- Risk posed by managing the IDW onsite
- Compliance with regulatory requirements
- IDW minimization and consistency with the IDW remedy and the site remedy

In all cases the client should approve the plans for IDW. Formal plans for the management of IDW must be prepared as part of a work plan or separate document.

5.1 Onsite Disposal

5.1.1 Soil/Sludge/Sediment

The options for handling soil/sludge/sediment IDW are as follows:

1. Return to boring, pit, or source immediately after generation as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).

2. Spread around boring, pit, or source within the area of contamination (AOC) as long as returning the media to these areas will not increase site risks (e.g., direct contact with surficial contamination).

3. Consolidate in a pit within the AOC as long as returning the media to these areas will not increase site risks (e.g., the contaminated soil will not be replaced at a greater depth than where it was originally so that it will not contaminate "clean" areas).

4. Send to onsite TSDF - may require analytical analysis prior to treatment/disposal.

Note: These options may require client and/or regulatory approval.

5.1.2 Aqueous Liquids
The options for handling aqueous liquid IDW are as follows:

1. Discharge to surface water, only when IDW is not contaminated.

2. Discharge to ground surface close to the well, only if soil contaminants will not be mobilized in the process and the action will not contaminate clean areas. If IDW from the sampling of background upgradient wells is not a community concern or associated with soil contamination, this presumably uncontaminated IDW may be released on the ground around the well.

3. Discharge to sanitary sewer.

4. Send to onsite TSDF - may require analysis prior to treatment/disposal.

Note: These options may require analytical results to obtain client and/or regulatory approval.

5.1.3 Disposable PPE
The options for handling disposable PPE are as follows:

1. Double-bag contents in non-transparent trash bags and place in onsite industrial dumpster, only if PPE is not contaminated.

2. Containerize, label, and send to onsite TSDF - may require analysis prior to treatment/disposal.

5.2 Offsite Disposal
Before sending to an offsite TSDF, analysis may be required. Also, manifests are required. Arrangements must be made with the client responsible for the site; it is CDM's policy not to sign manifests. The TSDF and transporter must be permitted for the respective wastes.

5.2.1 Soil/Sludge/Sediment
When the final site remedy requires offsite treatment and disposal, the IDW may be stored (e.g., drummed, covered in a waste pile) or returned to its source until final disposal. The management option selected should take into account the potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.2 Aqueous Liquids
When the final site remedy requires offsite treatment and disposal, the IDW may be stored (e.g., mobile tanks or drums) until final disposal. The management option selected should take into account the

potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.2.3 Disposable PPE
When the final site remedy requires offsite treatment disposal, the IDW may be containerized and stored. The management option selected should take into account potential for increased risks, applicable regulations, and other relevant site-specific factors (e.g., weather, storage space, and public concern/perceptions).

5.3 Interim Measures
All interim measures must be approved by the client and regulatory agencies.

1. Storing IDW onsite until the final action may be practical in the following situations:

   A. Returning wastes (especially sludges and soils) to their onsite source area would require re-excavation for disposal in the final remediation alternative.

   B. Interim storage in containers may be necessary to provide adequate protection to human health and the environment.

   C. Offsite disposal options may trigger land disposal regulations under the Resource Conservation and Recovery Act (RCRA). Storing IDW until the final disposal of all wastes from the site will eliminate the need to address this issue more than once.

   D. Interim storage may be necessary to provide time for sampling and analysis.

2. Segregate and containerize all waste for future treatment and/or disposal.

   A. Containment options for soil/sludge/sediment may include drums or covered waste piles in AOC.

   B. Containment options for aqueous liquids may include mobile tanks or drums.

   C. Containment options for PPE may include drums or roll-off boxes.

6.0 Restrictions/Limitations
Site Managers Should Determine the Most Appropriate Disposal Option for Aqueous Liquids on a Site-Specific Basis. Parameters to consider, especially when determining the level of protection, include the volume of IDW, the contaminants present in the groundwater, the presence of contaminants in the soil at the site, whether the groundwater or surface water is a drinking water supply, and whether the groundwater plume is contained or moving. Special disposal/handling may be needed for drilling fluids because they may contain significant solid components.

Disposable sampling materials, disposable PPE, decontamination fluids, etc. will always be managed on a site-specific basis. **Under No Circumstances Should These Types of Materials Be Brought Back to the Office or Warehouse.**

7.0 References

Environmental Resource Center. 1992. *Hazardous Waste Management Compliance Handbook*, Van Nostrand Reinhold.

Institute of Hazardous Materials Management. 1992. *Handbook on Hazardous Materials Management*, 4th Ed.

U. S. Environmental Protection Agency. 1987. *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001.1.

U. S. Environmental Protection Agency. August 1990. *Low-Level Mixed Waste: A RCRA Perspective for NRC Licensees*, EPA/530-SW-90-057.

U. S. Environmental Protection Agency. May 1991. *Management of Investigation-Derived Wastes During Site Inspections*, EPA/540/G-91/009.

U. S. Environmental Protection Agency. January 1992. *Guide to Management of Investigation-Derived Wastes*, 9345.3-03FS.

U. S. Environmental Protection Agency, Region IV. May 1996 and 1997. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, revisions.

Attachment 1
IDW Management Options

Type of IDW	*Generation Processes*	*Management Options*
Soil	■ Well/Test pit installations ■ Borehole drilling ■ Soil sampling	**Onsite Disposal** ■ Return to boring, pit, or source immediately after generation ■ Spread around boring, pit, or source within the AOC ■ Consolidate in a pit (within the AOC) ■ Send to onsite TSDF **Offsite Disposal** ■ Client to send to offsite TSDF **Interim Management** ■ Store for future treatment and/or disposal
Sludge/Sediment	■ Sludge pit/sediment sampling	**Onsite Disposal** ■ Return to boring, pit, or source immediately after generation ■ Send to onsite TSDF **Offsite Disposal** ■ Client to send to offsite TSDF **Interim Management** ■ Store for future treatment and/or disposal
Aqueous Liquids (groundwater, surface water, drilling fluids, wastewaters)	■ Well installation/development ■ Well purging during sampling ■ Groundwater discharge during pump tests ■ Surface water sampling ■ Wastewater sampling	**Onsite Disposal** ■ Pour onto ground close to well (nonhazardous waste) ■ Discharge to sewer ■ Send to onsite TSDF **Offsite Disposal** ■ Client to send to offsite commercial treatment unit ■ Client to send to publicly owned treatment works (POTW) **Interim Management** ■ Store for future treatment and/or disposal
Decontamination Fluids	■ Decontamination of PPE and equipment	**Onsite Disposal** ■ Send to onsite TSDF ■ Evaporate (for small amounts of low contamination organic fluids) ■ Discharge to ground surface **Offsite Disposal** ■ Client to send to offsite TSDF ■ Discharge to sewer **Interim Management** ■ Store for future treatment and/or disposal
Disposable PPE and Sampling Equipment	■ Sampling procedures or other onsite activities	**Onsite Disposal** ■ Place in onsite industrial dumpster ■ Send to onsite TSDF **Offsite Disposal** ■ Client to send to offsite TSDF **Interim Management** ■ Store for future treatment and/or disposal

Adapted from U.S. Environmental Protection Agency, Guide to Management of Investigation-Derived Wastes, 9345-03FS, January 1992.

Field Logbook Content and Control

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Technical Review: Sharon Budney

QA Review: Douglas J. Updike

Approved: Michael C. Mally 2/24/04
Signature/Date

Issued: 2/18/04
Signature/Date

1.0 Objective

The objective of this standard operating procedure (SOP) is to set CDM Federal (CDM) criteria for content entry and form of field logbooks. Field logbooks are an essential tool to document field activities for historical and legal purposes.

2.0 Background

2.1 Definitions

Biota - The flora and fauna of a region.

Magnetic Declination Corrections - Compass adjustments to correct for the angle between magnetic north and geographical meridians.

2.2 Discussion

Information recorded in field logbooks includes field team names, observations, data, calculations, date/time, weather, and description of the data collection activity, methods, instruments, and results. Additionally, the logbook may contain deviations from plans and descriptions of wastes, biota, geologic material, and site features including sketches, maps, or drawings as appropriate.

3.0 Responsibilities

Field Team Leader (FTL) - The FTL is responsible for ensuring that the format and content of data entries are in accordance with this procedure.

Site Personnel - All CDM employees who make entries in field logbooks during onsite activities are required to read this procedure prior to engaging in this activity. The FTL will assign field logbooks to site personnel who will be responsible for their care and maintenance. Site personnel will return field logbooks to the records file at the end of the assignment.

4.0 Required Equipment

- Site-specific plans
- Field notebook
- Indelible black or blue ink pen
- Ruler or similar scale

5.0 Procedures

5.1 Preparation

In addition to this SOP, site personnel responsible for maintaining logbooks must be familiar with all procedures applicable to the field activity being performed. These procedures should be consulted as necessary to obtain specific information about equipment and supplies, health and safety, sample collection, packaging, decontamination, and documentation. These procedures should be located at the field office.

Field logbooks shall be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the logbook. Prior to use in the field, each logbook will be marked with a specific document control number issued by the document control administrator, if required by the contract quality implementation plan (QIP). Not all contracts require document control numbers. The following information shall be recorded on the cover of the logbook:

- Field logbook document control number.
- Activity (if the logbook is to be activity-specific) and location.
- Name of CDM contact and phone number(s).
- Start date.
- In specific cases, special logbooks may be required (e.g., waterproof paper for stormwater monitoring).

The first few (approximately five) pages of the logbook will be reserved for a table of contents (TOC). Mark the first page with the heading and enter the following:

Table of Contents

Date/Description	Page
(Start Date)/Reserved for TOC	1-5

The remaining pages of the table of contents will be designated as such with "TOC" written on the top center of each page.

5.2 Operation

Requirements that must be followed when using a logbook:

- Record work, observations, quantities of materials, calculations, drawings, and related information directly in the logbook. If data collection forms are specified by an activity-specific plan, this information need not be duplicated in the logbook. However, any forms used to record site information must be referenced in the logbook.
- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Do not erase or blot out any entry at any time. Indicate any deletion by a single line through the material to be deleted. Initial and date each deletion. Take care to not obliterate what was written previously.
- Do not remove any pages from the book.

Field Logbook Content and Control

Specific requirements for field logbook entries include:

- Initial and date each page.
- Sign and date the final page of entries for each day.
- Initial and date all changes.
- Multiple authors must sign out the logbook by inserting the following:
  Above notes authored by:
  - (Sign name)
  - (Print name)
  - (Date)
- A new author must sign and print his/her name before additional entries are made.
- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:
  - Date and time
  - Name of individual making entry
  - Names of field team and other persons onsite
  - Description of activity being conducted including station or location (i.e., well, boring, sampling location number) if appropriate
  - Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data
  - Level of personal protection to be used
  - Serial numbers of instruments
  - Required calibration information
  - Serial/tracking numbers on documentation (e.g., carrier air bills)

Entries into the field logbook shall be preceded with the time (written in military units) of the observation. The time should be recorded frequently and at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless they are documented by automatic methods (e.g., data logger) or on a separate form required by an operating procedure. In these cases, the logbook must reference the automatic data record or form.

At each station where a sample is collected or an observation or measurement made, a detailed description of the location of the station is required. Use a compass (include a reference to magnetic declination corrections), scale, or nearby survey markers, as appropriate. A sketch of station location may be warranted. All maps or sketches made in the logbook should have descriptions of the features shown and a direction indicator. It is preferred that maps and sketches be oriented so that north is toward the top of the page. Maps, sketches, figures, or data that will not fit on a logbook page should be referenced and attached to the logbook to prevent separation.

Other events and observations that should be recorded include:

- Changes in weather that impact field activities.
- Deviations from procedures outlined in any governing documents. Also record the reason for any noted deviation.
- Problems, downtime, or delays.
- Upgrade or downgrade of personal protection equipment.

5.3 Post-Operation

To guard against loss of data due to damage or disappearance of logbooks, completed pages shall be periodically photocopied (weekly, at a minimum) and forwarded to the field or project office. Other field records shall be photocopied and submitted regularly and as promptly as possible to the office. When possible, electronic media such as disks and tapes should be copied and forwarded to the project office.

At the conclusion of each activity or phase of site work, the individual responsible for the logbook will ensure that all entries have been appropriately signed and dated, and that corrections were made properly (single lines drawn through incorrect information, then initialed and dated). The completed logbook shall be submitted to the records file.

6.0 Restrictions/Limitations

Field logbooks constitute the official record of onsite technical work, investigations, and data collection activities. Their use, control, and ownership are restricted to activities pertaining to specific field operations carried out by CDM personnel and their subcontractors. They are documents that may be used in court to indicate dates, personnel, procedures, and techniques employed during site activities. Entries made in these logbooks should be factual, clear, precise, and non-subjective. Field logbooks, and entries within, are not to be used for personal use.

7.0 References

Sandia National Laboratories, *Procedure for Preparing Sampling and Analysis Plan, Site-Specific Sampling Plan, and Field Operating Procedures*, QA-02-03, Albuquerque Environmental Program Department 3220, Albuquerque, New Mexico, 1991.

Sandia National Laboratories, Division 7723, *Field Operation Procedure for Field Logbook Content and Control, Environmental Restoration Department*, Albuquerque, New Mexico, 1992.

Project-Specific Modification

SOP No.: 4-2

SOP Title: Photographic Documentation of Field Activities

Project: Libby Asbestos Remedial Investigation (RI)

Project No.: 3282-137

Client: U.S. Environmental Protection Agency

Project Manager: _____ Date: 5/7/03

Technical Reviewer: _____ Date: 5/7/03

QA Reviewer: _____ Date: 5/12/03

EPA Approval: _____ Date: 5/19/03

Reason for and duration of modification: Site-specific procedures for photographs taken by digital cameras are different than the current SOP.

All photographs will be recorded in accordance with CDM Technical SOP 4-2, Photographic Documentation of Field Activities, with the following modifications:

Section 5.2.2, General Guidelines for Still Photography - A slate is not required for each new roll of film. The information for the slate will be recorded in the field logbook. The numbers assigned by the digital camera will be used instead of the photographer assigning the number. The caption information will either be on the back of the photograph or the photograph will be numbered or labeled and the caption information listed next to the number or label in the photograph log. On the digital photos, a caption will be included in the picture stating property address/location, date, and name of feature. All team members, as stated in the logbook, will be photographers and witnesses at the property. Slates are not required for close-up photographs. Instead the required information can be listed in the logbook or photograph log. A color strip is not required for close-up or feature photographs.

Section 5.2.4, Photographic Documentation - The name of the laboratory, time and date of drop-off, and receipt of film is not required to be recorded for this project.

Project-Specific Modification

Section 5.3.2, Archive Procedures - Digital photographs will be archived on compact discs. These discs will be assigned a document control dumber written on the disc case as well as well as the disc.

Photographic Documentation of Field Activities

Prepared: David O. Johnson

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QA Review: Laura Splichal

Approved: Michael C. Molly 2/24/04
Signature/Date

Issued: 3/18/04
Signature/Date

1.0 Objective

The purpose of this standard operating procedure (SOP) is to provide standard guidelines and methods for photographic documentation, which include still and digital photography and videotape recordings of field activities and site features (geologic formations, core sections, lithologic samples, water samples, general site layout, etc.). This document shall provide guidelines designed for use by a professional or amateur photographer. This SOP is intended for circumstances when formal photographic documentation is required. Based on project requirements, it may not be applicable for all photographic activities.

2.0 Background

2.1 Definitions

Photographer - A photographer is the camera operator (professional or amateur) of still photography, including digital photography, or videotape recording whose primary function with regard to this SOP is to produce documentary or data-oriented visual media.

Identifier Component - Identifier components are visual components used within a photograph such as visual slates, reference markers, and pointers.

Standard Reference Marker - A standard reference marker is a reference marker that is used to indicate a feature size in the photograph and is a standard length of measure, such as a ruler, meter stick, etc. In limited instances, if a ruled marker is not available or its use is not feasible, it can be a common object of known size placed within the visual field and used for scale.

Slates - Slates are blank white index cards or paper used to present information pertaining to the subject/procedure being photographed. Letters and numbers on the slate will be bold and written with black, indelible marking pens.

Arrows and Pointers - Arrows and pointers are markers/pointers used to indicate and/or draw attention to a special feature within the photograph.

Contrasting Backgrounds - Contrasting backgrounds are backdrops used to lay soil samples, cores, or other objects on for clearer viewing and to delineate features.

Data Recording Camera Back - A data recording camera back is a camera attachment or built-in feature that will record, at the very least, frame numbers and dates directly on the film.

2.2 Discussion

Photographs and videotape recordings made during field investigations are used as an aid in documenting and describing site features, sample collection activities, equipment used, and possible

lithologic interpretation. This SOP is designed to illustrate the format and desired placement of identifier components, such as visual slates, standard reference markers, and pointers. These items shall become an integral part of the "visual media" that, for the purpose of this document, shall encompass still photographs, digital photographs, and videotape recordings (or video footage). The use of a photographic logbook and standardized entry procedures are also outlined. These procedures and guidelines will minimize potential ambiguities that may arise when viewing the visual media and ensure the representative nature of the photographic documentation.

2.3 Associated Procedures

- CDM Federal SOP 4-1, Field Logbook Content and Control

3.0 Responsibilities

Field Team Leader (FTL) - The FTL is responsible for ensuring that the format and content of photographic documentation are in accordance with this procedure. The FTL is responsible for directing the photographer to specific situations, site features, or operations that the photographer will be responsible for documenting.

Photographer - The photographer shall seek direction from the FTL and regularly discuss the visual documentation requirements and schedule. The photographer is responsible for maintaining a logbook per Sections 5.1, 5.2.4, and 5.3.1 of this SOP.

4.0 Required Equipment

The following is a general list of equipment that may be used:

- 35mm camera or disposable single use camera (35mm or panoramic use)
- Digital camera
- Extra batteries for 35mm camera
- Video camera
- Logbook
- Indelible black or blue ink pen
- Standard reference markers
- Slates
- Arrows or pointers
- Contrasting backgrounds
- Medium speed, or multi purpose fine-grain, color, 35 mm negative film or slide film (project dependent)
- Data recording camera back (if available)
- Storage medium for digital camera

5.0 Procedures

5.1 Documentation

A commercially available, bound logbook will be used to log and document photographic activities. Review the CDM Federal SOP 4-1, Field Logbook Content and Control and prepare all supplies needed for logbook entries.

Note: A separate photographic logbook is not required. A portion of the field logbook may be designated as the photographic log and documentation section.

5.1.1 Field - Health and Safety Considerations

There are no hazards that an individual will be exposed to specific to photographic documentation. However, site-specific hazards may arise depending on location or operation. Personal protective equipment used in this operation will be site-specific and dictated through requirements set by the site safety officer, site health and safety plan, and/or prescribed by the CDM Federal Corporate Health and Safety Program. The photographer should contact the site safety officer for health and safety orientation prior to commencing field activities. The site health and safety plan must be read prior to entry to the site, and all individuals must sign the appropriate acknowledgement that this has been done.

The photographer should be aware of any potential physical hazards while photographing the subject (e.g., traffic, low overhead hazard, edge of excavation).

5.2 Operation

5.2.1 General Photographic Activities in the Field

The following sections provide general guidelines that should be followed to visually document field activities and site features using still/digital cameras and video equipment. Listed below are general suggestions that the photographer should consider when performing activities under this SOP:

- The photographer should be prepared to make a variety of shots, from close-up to wide-angle. Many shots will be repetitive in nature or format especially close-up site feature photographs. Consideration should therefore be given to designing a system or technique that will provide a reliable repetition of performance.
- All still film photographs should be made using a medium speed, or multi purpose fine-grain, color negative film in the 35 mm format unless otherwise directed by the FTL.
- It is suggested that Kodak brand "Ektapress Gold Deluxe" film or equivalent be used as the standard film for the still photography requirements of the field activities. This film is stable at room temperature after exposure and will better survive the time lag between exposure and processing. It is suggested that film speed ASA 100 should be used for outdoor photographs in bright sunlight, ASA 200 film should be used in cloudy conditions, and ASA 400 film should be used indoors or for very low-light outdoor photographs.
- No preference of videotape brand or digital storage medium is specified and is left to the discretion of the photographer.
- The lighting for sample and feature photography should be oriented toward a flat condition with little or no shadow. If the ambient lighting conditions are inadequate, the photographer should be prepared to augment the light (perhaps with reflectors or electronic flash) to maintain the desired visual effect.
- Digital cameras have multiple photographic quality settings. A camera that obtains a higher resolution (quality) has a higher number of pixels and will store a fewer number of photographs per digital storage medium.

5.2.2 General Guidelines for Still Photography

Slate Information

When directed by the FTL, each new roll of film or digital storage medium shall contain on the first usable frame (for film) a slate with consecutively assigned control numbers (a consecutive, unique number that is assigned by the photographer as in sample numbers).

Caption Information
All still photographs will have a full caption permanently attached to the back or permanently attached to a photo log sheet. The caption should contain the following information (digital photographs should have a caption added after the photographs are downloaded):

- Film roll control number (if required) and photograph sequence number
- Date and time
- Description of activity/item shown (e.g., name of facility/site, specific project name, project no.)
- Direction (if applicable)
- Photographer

When directed by the FTL, a standard reference marker should be used in all documentary visual media. While the standard reference marker will be predominantly used in close-up feature documentation, inclusion in all scenes should be considered.

Digital media should be downloaded at least once each day.

Close-Up and Feature Photography
When directed by the FTL, close-up photographs should include a standard reference marker of appropriate size as an indication of the feature size and contain a slate marked with the site name and any identifying label, such as a well number or core depth, that clearly communicates to the viewer the specific feature being photographed.

Feature samples, core pieces, and other lithologic media should be photographed as soon as possible after they have been removed from their in situ locations. This enables a more accurate record of their initial condition and color. When directed by the FTL, include a standard reference color strip (color chart such as Munsell Soil Color Chart or that available from Eastman Kodak Co.) within the scene. This is to be included for the benefit of the viewer of the photographic document and serves as a reference aid to the viewer for formal lithologic observations and interpretations.

Site Photography
Site photography, in general, will consist predominantly of medium and wide-angle shots. A standard reference marker should be placed adjacent to the feature or, when this is not possible, within the same focal plane.

While it is encouraged that a standard reference marker and caption/slate be included in the scene, it is understood that situations will arise that preclude their inclusion within the scene. This will be especially true of wide-angle shots. In such a case, the film/tape control number shall be entered in the photographic logbook along with the frame number and all other information pertinent to the scene.

Panoramic
In situations where a wide-angle lens does not provide sufficient subject detail, a single-use disposable panoramic camera is recommended. If this type of camera is not available, a panoramic series of two or three photos would be appropriate. Panoramas can provide greater detail while covering a wide subject, such as an overall shot of a site.

To shoot a panoramic series using a standard 35 mm or digital camera, the following procedure is recommended.

- Use a stable surface or tripod to support the camera
- Allow a 20 to 30 percent overlap while maintaining a uniform horizon
- Complete two to three photos per series

5.2.3 General Photographic Documentation Using Video Cameras

As a reminder, it is not within the scope of this document to set appropriate guidelines for presentation or "show" videotape recording. The following guidelines are set for documentary videotape recordings only and should be implemented at the discretion of the FTL.

Documentary videotape recordings of field activities may include an audio slate for all scenes. At the beginning of each video session, an announcer will recite the following information: date, time (in military units), photographer, site ID number, and site location. This oral account may include any additional information clarifying the subject matter being recorded.

A standard reference marker may be used when taking close-up shots of site features with a video camera. The scene may also include a caption/slate. It should be placed adjacent and parallel to the feature being photographed.

It is recommended that a standard reference marker and caption/slate be included in all scenes. The caption information is vital to the value of the documentary visual media and should be included. If it is not included within the scene, it should be placed before the scene.

Original videotape recordings will not be edited. This will maintain the integrity of the information contained on the videotape. If editing is desired, a working copy of the original videotape recording can be made.

A label should be placed on the videotape with the appropriate identifying information (i.e., project name, project number, date, location, etc.).

5.2.4 Photographic Documentation

Photographic activities must be documented in a photographic logbook or in a section of the field logbook. The photographer will be responsible for making proper entries.

In addition to following the technical standards for logbook entry as referenced in CDM Federal SOP 4-1, the following information should be maintained in the appropriate logbook:

- Photographer name.
- If required, an entry shall be made for each new roll/tape control number assigned.
- Sequential tracking number for each photograph taken (for digital cameras, the camera-generated number may be used).
- Date and time (military time).
- Location.
- A description of the activity/item photographed.

- If needed, a description of the general setup, including approximate distance between the camera and the subject, may be recorded in the logbook.
- Record as much other information as possible to assist in the identification of the photographic document.

5.3 Post Operation

All film will be sent for development and printing to a photographic laboratory (to be determined by the photographer). The photographer will be responsible for arranging transport of the film from the field to the photographic laboratory. The photographer shall also be responsible for arranging delivery of the negatives and photographs, digital storage medium, or videotape to the project management representative.

5.3.1 Documentation

At the end of each day's photographic session, the photographer(s) will ensure that the appropriate logbook has been completely filled out and maintained as outlined in CDM Federal SOP 4-1.

5.3.2 *Archive Procedures*

1. Photographs and the associated set of uncut negatives, digital media, and original unedited documentary videotape recordings will be submitted to the project files and handled according to contract records requirements. The FTL will ensure their proper distribution.

2. Completed pages of the appropriate logbook will be copied weekly and submitted to the project files.

6.0 Restrictions/Limitations

This document is designed to provide a set of guidelines for the field amateur or professional photographer to ensure that an effective and standardized program of visual documentation is maintained.

It is not within the scope of this document to provide instruction in photographic procedures, nor is it within the scope of this document to set guidelines for presentation or "show" photography.

The procedures outlined herein are general by nature. The FTL is responsible for specific operational activity or procedure. Questions concerning specific procedures or requirements should be directed to the FTL.

Note: Some sites do not permit photographic documentation. Check with the site contact for any restrictions.

7.0 References

U.S. Army Corps of Engineers, *Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3*, February 2001, Appendix F.

U.S. Environmental Protection Agency, Region IV, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, Athens, Georgia, November 2001.

U.S. Environmental Protection Agency, National Enforcement Investigations Center, *Multi-Media Investigation Manual*, EPA-330/9-89-003-R, Revised March 1992, p. 85.

Prepared:	Dave Johnson	**Technical Review:**	Mike Clark
QA Review:	Doug Updike	**Approved:**	Michael C. Mally 12/21/04
Issued:	12/28/04		
	Signature/Date		*Signature/Date*

1.0 Objective

The objective of this standard operating procedure (SOP) is to establish the baseline requirements, procedures, and responsibilities inherent to the control and use of all measurement and test equipment (M&TE). Contractual obligations may require more specific or stringent requirements that must also be implemented.

2.0 Background

2.1 Definitions

Traceability - The ability to trace the history, application, or location of an item and like items or activities by means of recorded identification.

2.2 Discussion

M&TE may be government furnished (GF), rented or leased from an outside vendor, or purchased. It is essential that measurements and tests resulting from the use of this equipment be of the highest accountability and integrity. To facilitate that, the equipment shall be used in full understanding and compliance with the instructions and specifications included in the manufacturer's operations and maintenance and calibration procedures and in accordance with any other related project-specific requirements.

2.3 Associated Procedures

- CDM Federal (CDM) Technical SOP 4-1
- CDM Quality Procedures (QPs) 2.1 and 2.3
- Manufacturer's operating and maintenance and calibration procedures

3.0 Responsibilities

All staff with responsibility for the direct control and/or use of M&TE are responsible for being knowledgeable of and understanding and implementing the requirements contained herein as well as any other related project-specific requirements.

The project manager (PM) or designee (equipment coordinator, quality assurance coordinator, field team leader, etc.) is responsible for initiating and tracking the requirements contained herein.

4.0 Required Equipment

- Determine and implement M&TE related project-specific requirements
- The maintenance and calibration procedures must be followed when using M&TE
- Obtain the maintenance and calibration procedures if they are missing or incomplete
- Attach or include the maintenance and calibration procedures with the M&TE
- Prepare and record maintenance and calibration in an Equipment Log or a Field Log as appropriate (Figure 1)
- Maintain M&TE records
- Label M&TE requiring routine or scheduled calibration (when required)
- Perform maintenance and calibration using the appropriate procedure and calibration standards
- Identify and take action on nonconforming M&TE

5.0 Procedures

5.1 Determine if Other Related Project-Specific Requirements Apply

For All M&TE:

The PM or designee shall determine if M&TE related project-specific requirements apply. If M&TE related project-specific requirements apply, obtain a copy of them and review and implement as appropriate.

5.2 Obtain the Operating and Maintenance and Calibration Documents

For GF M&TE that is to be procured:

Requisitioner - Specify that the maintenance and calibration procedures be included.

For GF M&TE that is acquired as a result of a property transfer:

Receiver - Inspect the M&TE to determine whether maintenance and calibration procedures are included with the item. If missing or incomplete, order the appropriate documentation from the manufacturer.

For M&TE that is to be rented or leased from an outside vendor:

Requisitioner - Specify that the maintenance and calibration procedures, the latest calibration record, and the calibration standards certification be included. If this information is not delivered with the M&TE, ask Procurement to request it from the vendor.

5.3 Prepare and Record Maintenance and Calibration Records

For all M&TE:

PM or Designee - Record all maintenance and calibration events in a Field Log unless other project-specific requirements apply.

For GF M&TE only (does not apply to rented or leased M&TE):

If an Equipment Log is a project specific requirement, perform the following:

Receiver - Notify the PM or designee for the overall property control of the equipment of the receipt of an item of M&TE.

PM or Designee - Prepare a sequentially page numbered Equipment Log for the item using the maintenance and calibration form (or equivalent) from the CDM *Property Control Manual* (Figure 1).

PM or Designee and User - Record all maintenance and calibration events in an Equipment Log.

5.4 Label M&TE Requiring Calibration

For GF M&TE only (does not apply to rented or leased M&TE):

If calibration labeling is a project specific requirement, perform the following:

PM or Designee - Read the maintenance and calibration procedures to determine the frequency of calibration required.

PM or Designee - If an M&TE item requires calibration before use, affix a label to the item stating "Calibrate Before Use."

PM or Designee - If an M&TE item requires calibration at other scheduled intervals, e.g., monthly, annually, etc., affix a label listing the date of the last calibration, the date the item is next due for a calibration, the initials of the person who performed the calibration, and a space for the initials of the person who will perform the next calibration.

5.5 Operating, Maintaining or Calibrating an M&TE Item

For all M&TE:

PM or Designee and User - Operate, maintain, and calibrate M&TE in accordance with the maintenance and calibration procedures. Record maintenance and calibration actions in the Equipment Log or Field Log.

Figure 1

CDM
A subsidiary of Camp Dresser & McKee Inc.

Maintenance and Calibration

Date: Time: (AM/PM)

Employee Name:

Contract/Project:

Activity:

Equipment Description:

Equipment ID No.:

Equipment Serial No.:

Maintenance Performed:

Comments:

Signature: Date:

Calibration Standard:

Concentration of Standard:

Lot No. of Calibration Standard:

Expiration Date of Calibration Standard:

Pre-Calibration Reading:

Post-Calibration Reading:

Additional Readings:

Additional Readings:

Additional Readings:

Additional Readings:

Pre-Field Check Reading:

Post-Field Check Reading:

Adjustment(s):

Calibration: ☐ Passed ☐ Failed

Comments:

Signature: Date:

5.6 Shipment

For GF M&TE:

Shipper - Inspect the item to ensure that the maintenance and calibration procedures are attached to the shipping case, or included, and that a copy of the most recent Equipment Log entry page (if required) is included with the shipment. If the maintenance and calibration procedures and/or the current Equipment Log page (if required) is missing or incomplete, do not ship the item. Immediately contact the PM or designee and request a replacement.

For M&TE that is rented or leased from an outside vendor:

Shipper - Inspect the item to ensure that the maintenance and calibration procedures and latest calibration and standards certification records are included prior to shipment. If any documentation is missing or incomplete, do not ship the item. Immediately contact Procurement and request that they obtain the documentation from the vendor.

5.7 Records Maintenance

For GF M&TE:

PM or Designee - Create a file upon the initial receipt of an item of M&TE or calibration standard. Organize the files by contract origin and by M&TE item and calibration standard. Store all files in a cabinet, file drawer, or other appropriate storage media at the pertinent warehouse or office location.

PM or Designee - Maintain all original documents in the equipment file except for the packing slip and Field Log.

Receiver - Forward the original packing slip to Procurement and a photocopy to the PM or designee.

PM or Designee - File the photocopy of the packing slip in the M&TE file.

PM or Designee and User - Record all maintenance and calibration in an Equipment Log or Field Log (as appropriate.) File the completed Equipment Logs in the M&TE records. Forward completed Field Logs to the PM for inclusion in the project files.

For M&TE rented or leased from an outside vendor:

Receiver - Forward the packing slip to Procurement.

User - Forward the completed Field Log to the PM for inclusion in the project files.

User - Retain the most current maintenance and calibration record and calibration standards certifications with the M&TE item and forward previous versions to the PM for inclusion in the project files.

5.8 Traceability of Calibration Standards

For all items of M&TE:

PM or Designee and User - When ordering calibration standards, request nationally recognized standards as specified or required. Request commercially available standards when not otherwise specified or required. Or, request standards in accordance with other related project-specific requirements.

PM or Designee and User - Require certifications for standards that clearly state the traceability.

PM or Designee and User - Note standards that are perishable and consume or dispose of them on or before the expiration date.

PM or Designee - Require Material Safety Data Sheet to be provided with standards.

5.9 M&TE That Fails Calibration

For any M&TE item that cannot be calibrated or adjusted to perform accurately:

PM or Designee - Immediately discontinue use and segregate the item from other equipment. Notify the appropriate PM and take appropriate action in accordance with the CDM QP 2.3 for nonconforming items.

PM or Designee - Review the current and previous maintenance and calibration records to determine if the validity of current or previous measurement and test results could have been affected and notify the appropriate PM(s) of the results of the review.

6.0 Restrictions/Limitations

On an item-by-item basis, exemptions from the requirements of this SOP may be granted by the HDQ health and safety manager and/or HDQ quality assurance director. All exemptions shall be documented by the grantor and included in the equipment records as appropriate.

7.0 References

CDM Federal Programs Corporation *Property Control Manual.* 2002. March.

ASBESTOS SAMPLING

SOP#: 2015
DATE: 11/17/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

Asbestos has been used in many commercial products including building materials such as flooring tiles and sheet goods, paints and coatings, insulation, and roofing asphalts. These products and others may be found at hazardous waste sites hanging on overhead pipes, contained in drums, abandoned in piles, or as part of a structure. Asbestos tailing piles from mining operations can also be a source of ambient asbestos fibers. Asbestos is a known carcinogen and requires air sampling to assess airborne exposure to human health. This Standard Operating Procedure (SOP) provides procedures for asbestos air sampling by drawing a known volume of air through a mixed cellulose ester (MCE) filter. The filter is then sent to a laboratory for analysis. The U.S. Environmental Protection Agency/Environmental Response Team (U.S. EPA/ERT) uses one of four analytical methods for determining asbestos in air. These include: U.S. EPA's Environmental Asbestos Assessment Manual, Superfund Method for the Determination of Asbestos in Ambient Air for Transmission Electron Microscopy (TEM)[1]; U.S. EPA's Modified Yamate Method for TEM[2]; National Institute for Occupational Safety and Health (NIOSH) Method 7402 (direct method only) for TEM; and NIOSH Method 7400 for Phase Contrast Microscopy (PCM)[3]. Each method has specific sampling and analytical requirements (i.e., sample volume and flow rate) for determining asbestos in air.

The U.S. EPA/ERT typically follows procedures outlined in the TEM methods for determining mineralogical types of asbestos in air and for distinguishing asbestos from non-asbestos minerals. The Phase Contrast Microscopy (PCM) method is used by U.S. EPA/ERT as a screening tool since it is less costly than TEM. PCM cannot distinguish asbestos from non-asbestos fibers, therefore the TEM method may be necessary to confirm analytical results. For example, if an action level for the presence of fibers has been set and PCM analysis indicates that the action level has been exceeded, then TEM analysis can be used to quantify and identify asbestos structures through examination of their morphology crystal structures (through electron diffraction), and elemental composition (through energy dispersive X-ray analysis). In this instance samples should be collected for both analyses in side by side sampling trains (some laboratories are able to perform PCM and TEM analysis from the same filter). The Superfund method is designed specifically to provide results suitable for supporting risk assessments at Superfund sites, it is applicable to a wide range of ambient air situations at hazardous waste sites. U.S. EPA's Modified Yamate Method for TEM is also used for ambient air sampling due to high volume requirements. The PCM and TEM NIOSH analytical methods require lower sample volumes and are typically used indoors; however, ERT will increase the volume requirement for outdoor application.

Other Regulations pertaining to asbestos have been promulgated by U.S. EPA and OSHA. U.S. EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP) regulates asbestos-containing waste materials. NESHAP establishes management practices and standards for the handling of asbestos and emissions from waste disposal operations (40 CFR Part 61, Subparts A and M). U.S. EPA's 40 CFR 763 (July 1, 1987)[4] and its addendum 40 CFR 763 (October 30, 1987)[4] provide comprehensive rules for the asbestos abatement industry. State and local regulations on these issues vary and may be more stringent than federal requirements. The OSHA regulations in 29 CFR 1910.1001 and 29 CFR 1926.58 specify work practices and safety equipment such as respiratory protection and protective clothing when handling asbestos. The OSHA standard for an 8-hour, time-weighted average (TWA) is 0.2 fibers/cubic centimeters of air. This standard pertains to fibers with a length-to-width ratio of 3 to 1 with a fiber length >5 μm[5,6]. An action level of 0.1 fiber/cc (one-half the OSHA standard) is the level U.S. EPA has established in which employers must initiate such activities as air monitoring, employee training, and

medical surveillance[5,6].

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

Prior to sampling, the site should be characterized by identifying on-site as well as off-site sources of airborne asbestos. The array of sampling locations and the schedule for sample collection, is critical to the success of an investigation. Generally, sampling strategies to characterize a single point source are fairly straightforward, while multiple point sources and area sources increase the complexity of the sampling strategy. It is not within the scope of this SOP to provide a generic asbestos air sampling plan. Experience, objectives, and site characteristics will dictate the sampling strategy.

During a site investigation, sampling stations should be arranged to distinguish spatial trends in airborne asbestos concentrations. Sampling schedules should be fashioned to establish temporal trends. The sampling strategy typically requires that the concentration of asbestos at the source (worst case) or area of concern (downwind), crosswind, as well as background (upwind) contributions be quantified. See Table 1 (Appendix A) for U.S. EPA/ERT recommended sampling set up for ambient air. Indoor asbestos sampling requires a different type of strategy which is identified in Table 2 (Appendix A). It is important to establish background levels of contaminants in order to develop a reference point from which to evaluate the source data. Field blanks and lot blanks can be utilized to determine other sources.

Much information can be derived from each analytical method previously mentioned. Each analytical method has specific sampling requirements and produce results which may or may not be applicable to a specific sampling effort. The site sampling objectives should be carefully identified so as to select the most appropriate analytical method. Additionally, some preparation (i.e., lot blanks results) prior to site sampling may be required, these requirements are specified in the analytical methods.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

3.1 Sample Preservation

No preservation is required for asbestos samples.

3.2 Sample Handling, Container and Storage Procedures

1. Place a sample label on the cassette indicating a unique sampling number. Do not put sampling cassettes in shirt or coat pockets as the filter can pick up fibers. The original cassette box is used to hold the samples.

2. Wrap the cassette individually in a plastic sample bag. Each bag should be marked indicating sample identification number, total volume, and date.

3. The wrapped sampling cassettes should be placed upright in a rigid container so that the cassette cap is on top and cassette base is on bottom. Use enough packing material to prevent jostling or damage. Do not use vermiculite as packing material for samples. If possible, hand carry to lab.

4. Provide appropriate documentation with samples (i.e., chain of custody and requested analytical methodology).

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Flow rates exceeding 16 liters/minute (L/min) which could result in filter destruction due to (a) failure of its physical support under force from the increased pressure drop; (b) leakage of air around the filter mount so that the filter is bypassed, or (c) damage to the asbestos structures due to increased impact velocities.

4.1 U.S. EPA's Superfund Method

4.1.1 Direct-transfer TEM Specimen Preparation Methods

Direct-Transfer TEM specimen preparation methods have the following significant interferences:

- The achievable detection limit is restricted by the particulate density on the filter, which in turn is controlled by the sampled air volume and the total suspended particulate concentration in the atmosphere being sampled.
- The precision of the result is dependent on the uniformity of the deposit of asbestos structures on the sample collection filter.
- Air samples must be collected so that they have particulate and fiber loadings within narrow ranges. If too high a particulate loading occurs on the filter, it is not possible to prepare satisfactory TEM specimens by a direct-transfer method. If too high a fiber loading occurs on the filter, even if satisfactory TEM specimens can be prepared, accurate fiber counting will not be possible.

4.1.2 Indirect TEM Specimen Preparation Methods

Indirect TEM specimen preparation methods have the following interferences:

- The size distribution of asbestos structures is modified.
- There is increased opportunity for fiber loss or introduction of extraneous contamination.
- When sample collection filters are ashed, any fiber contamination in the filter medium is concentrated on the TEM specimen grid.

It can be argued that direct methods yield an under-estimate of the asbestos structure concentration because many of the asbestos fibers present are concealed by other particulate material with which they are associated. Conversely, indirect methods can be considered to yield an over-estimate because some types of complex asbestos structures disintegrate during the preparation, resulting in an increase in the numbers of structures counted.

4.2 U.S. EPA's Modified Yamate Method for TEM

High concentrations of background dust interfere with fiber identification.

4.3 NIOSH Method for TEM

Other amphibole particles that have aspect ratios greater than 3:1 and elemental compositions similar to the asbestos minerals may interfere in the TEM analysis. Some non-amphibole minerals may give electron diffraction patterns similar to amphiboles. High concentrations of background dust interfere with fiber identification.

4.4 NIOSH Method for PCM

PCM cannot distinguish asbestos from non-asbestos fibers; therefore, all particles meeting the counting criteria are counted as total asbestos fibers. Fiber less than 0.25 um in length will not be detected by this method. High levels of non-fibrous dust particles may obscure fibers in the field of view and increase the detection limit.

5.0 EQUIPMENT/MATERIALS

5.1 Sampling Pump

The constant flow or critical orifice controlled sampling pump should be capable of a flow-rate and pumping time sufficient to achieve the desired volume of air sampled.

The lower flow personal sampling pumps generally provide a flow rate of 20 cubic centimeters/minute (cc/min) to 4 L/min. These pumps are usually battery powered. High flow pumps are utilized when flow rates between 2 L/min to 20 L/min are required. High flow pumps are used for short sampling periods so as to obtain the desired sample volume. High flow pumps usually run on AC power and can be plugged into a nearby outlet. If an outlet is not available then a generator should be obtained. The generator should be positioned downwind from the sampling pump. Additional voltage may be required if more than one pump is plugged into the same generator. Several

electrical extension cords may be required if sampling locations are remote.

The recommended volume for the Superfund method (Phase I) requires approximately 20 hours to collect. Such pumps typically draw 6 amps at full power so that 2 lead/acid batteries should provide sufficient power to collect a full sample. The use of line voltage, where available, eliminates the difficulties associated with transporting stored electrical energy.

A stand should be used to hold the filter cassette at the desired height for sampling and the filter cassette shall be isolated from the vibrations of the pump.

5.2 Filter Cassette

The cassettes are purchased with the required filters in position, or can be assembled in a laminar flow hood or clean area. When the filters are in position, a shrink cellulose band or adhesive tape should be applied to cassette joints to prevent air leakage.

5.2.1 TEM Cassette Requirements

Commercially available field monitors, comprising 25 mm diameter three-piece cassettes, with conductive extension cowls shall be used for sample collection. The cassette must be new and not previously used. The cassette shall be loaded with an MCE filter of pore size 0.45 µm, and supplied from a lot number which has been qualified as low background for asbestos determination. The cowls should be constructed of electrically conducting material to minimize electrostatic effects. The filter shall be backed by a 5 µm pore size MCE filter (Figure 1, Appendix B).

5.2.2 PCM Cassette Requirements

NIOSH Method 7400, PCM involves using a 0.8 to 1.2 µm mixed cellulose ester membrane, 25 mm diameter, 50 mm conductive cowl on cassette (Figure 2, Appendix B). Some labs are able to perform PCM and TEM analysis on the same filter; however, this should be discussed with the laboratory prior to sampling.

5.3 Other Equipment

- Inert tubing with glass cyclone and hose barb
- Whirlbags (plastic bags) for cassettes
- Tools - small screw drivers
- Container - to keep samples upright
- Generator or electrical outlet (may not be required)
- Extension cords (may not be required)
- Multiple plug outlet
- Sample labels
- Air data sheets
- Chain of Custody records

6.0 REAGENTS

Reagents are not required for the preservation of asbestos samples.

7.0 PROCEDURES

7.1 Air Volumes and Flow Rates

Sampling volumes are determined on the basis of how many fibers need to be collected for reliable measurements. Therefore, one must estimate how many airborne fibers may be in the sampling location.

Since the concentration of airborne aerosol contaminants will have some effect on the sample, the following is a suggested criteria to assist in selecting a flow rate based on real-time aerosol monitor (RAM) readings in milligrams/cubic meter (mg/m^3).

	Concentration	Flow Rate
• Low RAM readings:	<6.0 mg/m^3	11-15. L/min
• Medium RAM readings:	>6.0 mg/m_3	7.5 L/min
• High RAM readings:	>10. mg/m^3	2.5 L/min

In practice, pumps that are available for environmental sampling at remote locations operate under a maximum load of approximately 12 L/min.

7.1.1 U.S. EPA's Superfund Method

The Superfund Method incorporates an indirect preparation procedure to provide flexibility in the amount of deposit that be can be tolerated on the sample filter and to allow for the selective concentration of asbestos prior to analysis. To minimize contributions to background contamination from asbestos present in the plastic matrices of membrane filters while allowing for sufficient quantities of asbestos to be collected, this method also requires the collection of a larger volume of air per unit area of filter than has traditionally been collected

for asbestos analysis. Due to the need to collect large volumes of air, higher sampling flow rates are recommended in this method than have generally been employed for asbestos sampling in the past. As an alternative, samples may be collected over longer time intervals. However, this restricts the flexibility required to allow samples to be collected while uniform meteorological conditions prevail.

The sampling rate and the period of sampling should be selected to yield as high a sampled volume as possible, which will minimize the influence of filter contamination. Wherever possible, a volume of 15 cubic meters (15,000 L) shall be sampled for those samples intended for analysis only by the indirect TEM preparation method (Phase 1 samples). For those samples to be prepared by both the indirect and the direct specimen preparation methods (Phase 2 samples), the volumes must be adjusted so as to provide a suitably-loaded filter for the direct TEM preparation method. One option is to collect filters at several loadings to bracket the estimated optimum loading for a particular site. Such filters can be screened in the laboratory so that only those filters closest to optimal loading are analyzed. It has been found that the volume cannot normally exceed 5 cubic meters (5000 L) in an urban or agricultural area, and 10 cubic meters (10,000 L) in a rural area for samples collected on a 25 mm filter and prepared by a direct-transfer technique.

An upper limit to the range of acceptable flow rates for this method is 15 L/min. At many locations, wind patterns exhibit strong diurnal variations. Therefore, intermittent sampling (sampling over a fixed time interval repeated over several days) may be necessary to accumulate 20 hours of sampling time over constant wind conditions. Other sampling objectives also may necessitate intermittent sampling. The objective is to design a sampling schedule so that samples are collected under uniform conditions throughout the sampling interval. This method provides for such options. Air volumes collected on Phase I samples are maximized (<16 L/min). Air volumes collected on Phase 2 samples are limited to provide optimum loading for filters to be prepared by a direct-transfer procedure.

7.1.2 U.S. EPA's Modified Yamate Method for TEM

U.S. EPA's TEM method requires a minimum volume of 560 L and a maximum volume of 3,800 L in order to obtain an analytical sensitivity of 0.005 structures/cc. The optimal volume for TEM is 1200 L to 1800 L. These volumes are determined using a 200 mesh EM grid opening with a 25-mm filter cassette. Changes in volume would be necessary if a 37-mm filter cassette is used since the effective area of a 25 mm (385 sq mm) and 37 mm (855 sq m) differ.

7.1.3 NIOSH Method for TEM and PCM

The minimum recommended volume for TEM and PCM is 400 L at 0.1 fiber/cc. Sampling time is adjusted to obtain optimum fiber loading on the filter. A sampling rate of 1 to 4 L/min for eight hours (700 to 2800 L) is appropriate in non-dusty atmospheres containing 0.1 fiber/cc. Dusty atmospheres i.e., areas with high levels of asbestos, require smaller sample volumes (<400 L) to obtain countable samples.

In such cases, take short, consecutive samples and average the results over the total collection time. For documenting episodic exposures, use high flow rates (7 to 16 L/min) over shorter sampling times. In relatively clean atmospheres where targeted fiber concentrations are much less than 0.1 fiber/cc, use larger sample volumes (3,000 to 10,000 L) to achieve quantifiable loadings. Take care, however, not to overload the filter with background dust. If > 50% of the filter surface is covered with particles, the filter may be too overloaded to count and will bias the measured fiber concentration. Do not exceed 0.5 mg total dust loading on the filter.

7.2 Calibration Procedures

In order to determine if a sampling pump is measuring the flow rate or volume of air correctly, it is necessary to calibrate the instrument. Sampling pumps should be calibrated immediately before and after each use. Preliminary calibration should be conducted using a primary calibrator such as a soap bubble type calibrator, (e.g., a Buck Calibrator, Gilibrator, or equivalent primary calibrator) with a representative filter cassette installed between the pump and the calibrator. The representative sampling cassette can be reused for calibrating other pumps that will be used for asbestos sampling. The same cassette lot used for sampling should also be used for the calibration. A sticker should be affixed to the outside of the extension cowl marked "Calibration Cassette."

A rotameter can be used provided it has been recently precalibrated with a primary calibrator. Three separate constant flow calibration readings should be obtained both before sampling and after sampling. Should the flow rate change by more than 5% during the sampling period, the average of the pre- and post-calibration rates will be used to calculate the total sample volume. The sampling pump used shall provide a non-fluctuating air-flow through the filter, and shall maintain the initial volume flow-rate to within ± 10% throughout the sampling period. The mean value of these flow-rate measurements shall be used to calculate the total air volume sampled. A constant flow or critical orifice controlled pump meets these requirements. If at any time the measurement indicates that the flow-rate has decreased by more than 30%, the sampling shall be terminated. Flexible tubing is used to connect the filter cassette to the sampling pump.Sampling pumps can be calibrated prior to coming on-site so that time is saved when performing on-site calibration.

7.2.1 Calibrating a Personal Sampling Pump with an Electronic Calibrator

1. See Manufacturer's manual for operational instructions.

2. Set up the calibration train as shown in (Figure 3, Appendix B) using a sampling pump, electronic calibrator, and a representative filter cassette. The same lot sampling cassette used for sampling should also be used for calibrating.

3. To set up the calibration train, attach one end of the PVC tubing (approx. 2 foot) to the cassette base; attach the other end of the tubing to the inlet plug on the pump. Another piece of tubing is attached from the cassette cap to the electronic calibrator.

4. Turn the electronic calibrator and sampling pump on. Create a bubble at the bottom of the flow chamber by pressing the bubble initiate button. The bubble should rise to the top of the flow chamber. After the bubble runs its course, the flow rate is shown on the LED display.

5. Turn the flow adjust screw or knob on the pump until the desired flow rate is attained.

6. Perform the calibration three times until the desired flow rate of ± 5% is attained.

7.2.2 Calibrating a Rotameter with an Electronic Calibrator

1. See manufacturer's manual for operational instructions.

2. Set up the calibration train as shown in (Figure 4, Appendix B) using a sampling pump, rotameter, and electronic calibrator.

3. Assemble the base of the flow meter with the screw provided and tighten in place. The flow meter should be mounted within 6° vertical.

4. Turn the electronic calibrator and sampling pump on.

5. Create a bubble at the bottom of the flow chamber by pressing the bubble initiate button. The bubble should rise to the top of the flow chamber. After the bubble runs its course, the flow rate is shown on the LED display.

6. Turn the flow adjust screw or knob on the pump until the desired flow rate is attained.

7. Record the electronic calibrator flow rate reading and the corresponding rotameter reading. Indicate these values on the rotameter (sticker). The rotameter should be able to work within the desired flow range. Readings can also be calibrated for 10 cm^3 increments for Low Flow rotameters, 500 cm^3 increments for medium flow rotameters and 1 liter increments for high flow rotameters.

8. Perform the calibration three times until the desired flow rate of ± 5% is attained. Once on site, a secondary calibrator, i.e., rotameter may be used to calibrate sampling pumps.

7.2.3 Calibrating a Personal Sampling Pump with a Rotameter

1. See manufacturer's manual for Rotameter's Operational Instructions.

2. Set up the calibration train as shown in (Figure 5, Appendix B) using a rotameter, sampling pump, and a representative sampling cassette.

3. To set up the calibration train, attach one end of the PVC tubing (approx. 2 ft) to the cassette base; attach the other end of the tubing to the inlet plug on the pump. Another piece of tubing is attached from the cassette cap to the rotameter.

4. Assemble the base of the flow meter with the screw provided and tighten in place. The flow meter should be mounted within 6° vertical.

5. Turn the sampling pump on.

6. Turn the flow adjust screw (or knob) on the personal sampling pump until the float ball on the rotameter is lined up with the precalibrated flow rate value. A sticker on the rotameter should indicate this value.

7. A verification of calibration is generally performed on-site in the clean zone immediately prior to the sampling.

7.3. Meteorology

It is recommended that a meteorological station be established. If possible, sample after two to three days of dry weather and when the wind conditions are at 10 mph or greater. Record wind speed, wind direction, temperature, and pressure in a field logbook. Wind direction is particularly important when monitoring for asbestos downwind from a fixed source.

7.4 Ambient Sampling Procedures

7.4.1 Pre-site Sampling Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.

2. Obtain necessary sampling equipment and ensure it is in working order and fully charged (if necessary).

3. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety plan.

4. Once on-site the calibration is performed in the clean zone. The calibration procedures are listed in Section 7.2.

5. After calibrating the sampling pump, mobilize to the sampling location.

7.4.2 Site Sampling

1. To set up the sampling train, attach the air intake hose to the cassette base. Remove the cassette cap (Figure 6 and 7, Appendix B). The cassette should be positioned downward, perpendicular to the wind

2. If AC or DC electricity is required then turn it on. If used, the generator should be placed 10 ft. downwind from the sampling pump.

3. Record the following in a field logbook: date, time, location, sample identification number, pump number, flow rate, and cumulative time.

4. Turn the pump on. Should intermittent sampling be required, sampling filters must be covered between active periods of sampling. To cover the sample filter: turn the cassette to face upward, place the cassette cap on the cassette, remove the inlet plug from the cassette cap, attach a rotameter to the inlet opening of the cassette cap to measure the flow rate, turn off the sampling pump, place the inlet plug into the inlet opening on the cassette cap. To resume sampling: remove the inlet plug, turn on the sampling pump, attach a rotameter to measure the flow rate, remove the cassette cap, replace the inlet plug in the cassette cap and invert the cassette, face downward and perpendicular to the wind.

5. Check the pump at sampling midpoint if sampling is longer than 4 hours. The generators may need to be regased depending on tank size. If a filter darkens in appearance or if loose dust is seen in the filter, a second sample should be started.

6. At the end of the sampling period, orient the cassette up, turn the pump off.

7. Check the flow rate as shown in Section 7.2.3. When sampling open-faced, the sampling cap should be replaced before post calibrating. Use the same cassette used for sampling for post calibration (increase dust/fiber loading may have altered the flow rate.

8. Record the post flow rate.

9. Record the cumulative time or run.

10. Remove the tubing from the sampling cassette. Still holding the cassette upright, replace the inlet plug on the cassette cap and the outlet plug on the cassette base.

7.4.3. Post Site Sampling

1. Follow handling procedures in Section 3.2, steps 1-4.

2. Obtain an electronic or hard copy of meteorological data which occurred during the sampling event. Record weather: wind speed, ambient temperature, wind direction, and precipitation. Obtaining weather data several days prior to the sampling event can also be useful.

7.5 Indoor Sampling Procedures

PCM analysis is used for indoor air samples. When analysis shows total fiber count above the OSHA action level 0.1 f/cc then TEM (U.S. EPA's Modified Yamate Method) is used to identify asbestos from non-asbestos fibers.

Sampling pumps should be placed four to five feet above ground level away from obstructions that may influence air flow. The pump can be placed on a table or counter. Refer to Table 2 (Appendix A) for a summary of indoor sampling locations and rationale for selection.

Indoor sampling utilizes high flow rates to increased sample volumes (2000 L for PCM and 2800 to 4200 L for TEM) in order to obtain lower detection limits below the standard, (i.e., 0.01 f/cc or lower [PCM] and 0.005 structures/cc or lower [TEM]).

7.5.1 Aggressive Sampling Procedures

Sampling equipment at fixed locations may fail to detect the presence of asbestos fibers. Due to limited air movement, many fibers may settle out of the air onto the floor and other surfaces and may not be captured on the filter. In the past, an 8-hour sampling period was recommended to cover various air circulation conditions. A quicker and more effective way to capture asbestos fibers is to circulate the air artificially so that the fibers remain airborne during sampling. The results from this sampling option typifies worst case condition. This is referred to as aggressive air sampling for asbestos. Refer to Table 2 for sample station locations.

1. Before starting the sampling pumps, direct forced air (such as a 1-horsepower leaf blower or large fan) against walls, ceilings, floors, ledges, and other surfaces in the room to initially dislodge fibers from surfaces. This should take at least 5 minutes per 1000 sq. ft. of floor.

2. Place a 20-inch fan in the center of the room. (Use one fan per 10,000 cubic feet of room space.) Place the fan on slow speed and point it toward the ceiling.

3. Follow procedures in Section 7.4.1 and 7.4.2 (Turn off the pump and then the fan(s) when sampling is complete.).

4. Follow handling procedures in Section 3.2, steps 1-4.

8.0 CALCULATIONS

The sample volume is calculated from the average flow rate of the pump multiplied by the number of minutes the pump was running (volume = flow rate X time in minutes). The sample volume should be submitted to the laboratory and identified on the chain of custody for each sample (zero for lot, field and trip blanks).

The concentration result is calculated using the sample volume and the numbers of asbestos structures reported after the application of the cluster and matrix counting criteria.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

Follow all QA/QC requirements from the laboratories as well as the analytical methods.

9.1 TEM Requirements

1. Examine lot blanks to determine the background asbestos structure concentration.

2. Examine field blanks to determine whether there is contamination by extraneous asbestos structures during specimen preparation.

3. Examine of laboratory blanks to determine if contamination is being introduced during critical phases of the laboratory program.

4. To determine if the laboratory can satisfactorily analyze samples of known asbestos structure concentrations, reference filters shall be examined. Reference filters should be maintained as part of the laboratory's Quality Assurance program.

5. To minimize subjective effects, some specimens should be recounted by a different microscopist.

6. Asbestos laboratories shall be accredited by the National Voluntary Laboratory Accreditation Program.

7. At this time, performance evaluation samples for asbestos in air are not available for Removal Program Activities.

9.2 PCM Requirements

1. Examine reference slides of known concentration to determine the analyst's ability to satisfactorily count fibers. Reference slides should be maintained as part of the laboratory's quality assurance program.

2. Examine field blanks to determine if there is contamination by extraneous structures during sample handling.

3. Some samples should be relabeled then submitted for counting by the same analyst to determine possible bias by the analyst.

4. Participation in a proficiency testing program such as the AIHA-NIOSH proficiency analytical testing (PAT) program.

10.0 DATA VALIDATION

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results accordingly with the project's data quality objectives.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and corporate health and safety procedures. More specifically, when entering an unknown situation involving asbestos, a powered air purifying respirator (PAPR) (full face-piece) is necessary in conjunction with HEPA filter cartridges. See applicable regulations for action level, PEL, TLV, etc. If previous sampling indicates asbestos concentrations are below personal health and safety levels, then Level D personal protection is adequate.

12.0 REFERENCES

(1) Environmental Asbestos Assessment Manual, Superfund Method for the Determination of Asbestos in Ambient Air, Part 1: Method, EPA/540/2-90/005a, May 1990, and Part 2: Technical Background Document, EPA/540/2-90/005b, May 1990.

(2) Methodology for the Measurement of Airborne Asbestos by Electron Microscopy, EPA's Report No. 68-02-3266, 1984, G. Yamate, S.C. Agarwal, and R. D. Gibbons.

(3) National Institute for Occupational Safety and Health. NIOSH Manual of Analytical Method. Third Edition. 1987.

(4) U.S. Environmental Protection Agency. Code of Federal Regulations 40 CFR 763. July 1, 1987. Code of Federal Regulations 40 CFR 763 Addendum. October 30, 1987.

(5) U.S. Environmental Protection Agency. Asbestos-Containing Materials in Schools; Final Rule and Notice. 52 FR 41826.

(6) Occupational Safety and Health Administration. Code of Federal Regulations 29 CFR 1910.1001. Washington, D.C. 1987.

APPENDIX A

Tables

TABLE 1.

SAMPLE STATIONS FOR OUTDOOR SAMPLING

Sample Station Location	Sample Numbers	Rationale
Upwind/Background[1]	Collect a minimum of two simultaneous upwind/background samples 30° apart from the prevailing windlines.	Establishes background fiber levels.
Downwind	Deploy a minimum of 3 sampling stations in a 180 degree arc downwind from the source.	Indicates if asbestos is leaving the site.
Site Representative and/or Worst Case	Obtain one site representative sample which shows average condition on-site or obtain worst case sample (optional).	Verify and continually confirm and document selection of proper levels of worker protection.

[1] More than one background station may be required if the asbestos originates from different sources.

APPENDIX A (Cont'd)

Tables

TABLE 2

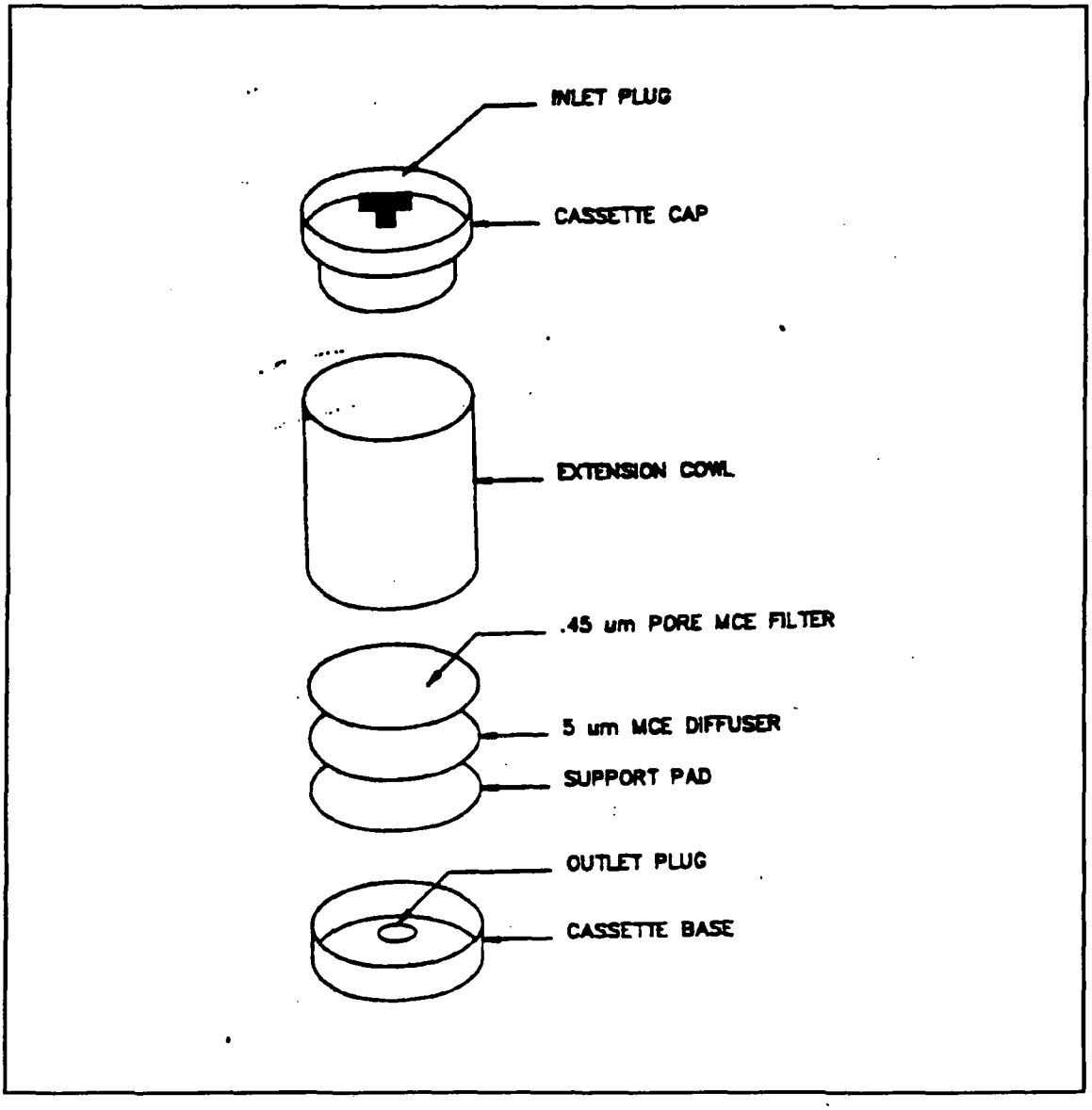
SAMPLE STATIONS FOR INDOOR SAMPLING

Sample Station Location	Sample Numbers	Rationale
Indoor Sampling	If a work site is a single room, disperse 5 samplers throughout the room. If the work site contains up to 5 rooms, place at least one sampler in each room. If the work site contains more than 5 rooms, select a representative sample of the rooms.	Establishes representative samples from a homogeneous area.
Upwind/Background	If outside sources are suspected, deploy a minimum of two simultaneous upwind/background samples 30° apart from the prevailing windlines.	Establish whether indoor asbestos concentrations are coming from an outside source.
Worst Case	Obtain one worst case sample, i.e., aggressive sampling (optional).	Verify and continually confirm and document selection of proper levels of worker protection.

APPENDIX B

Figures

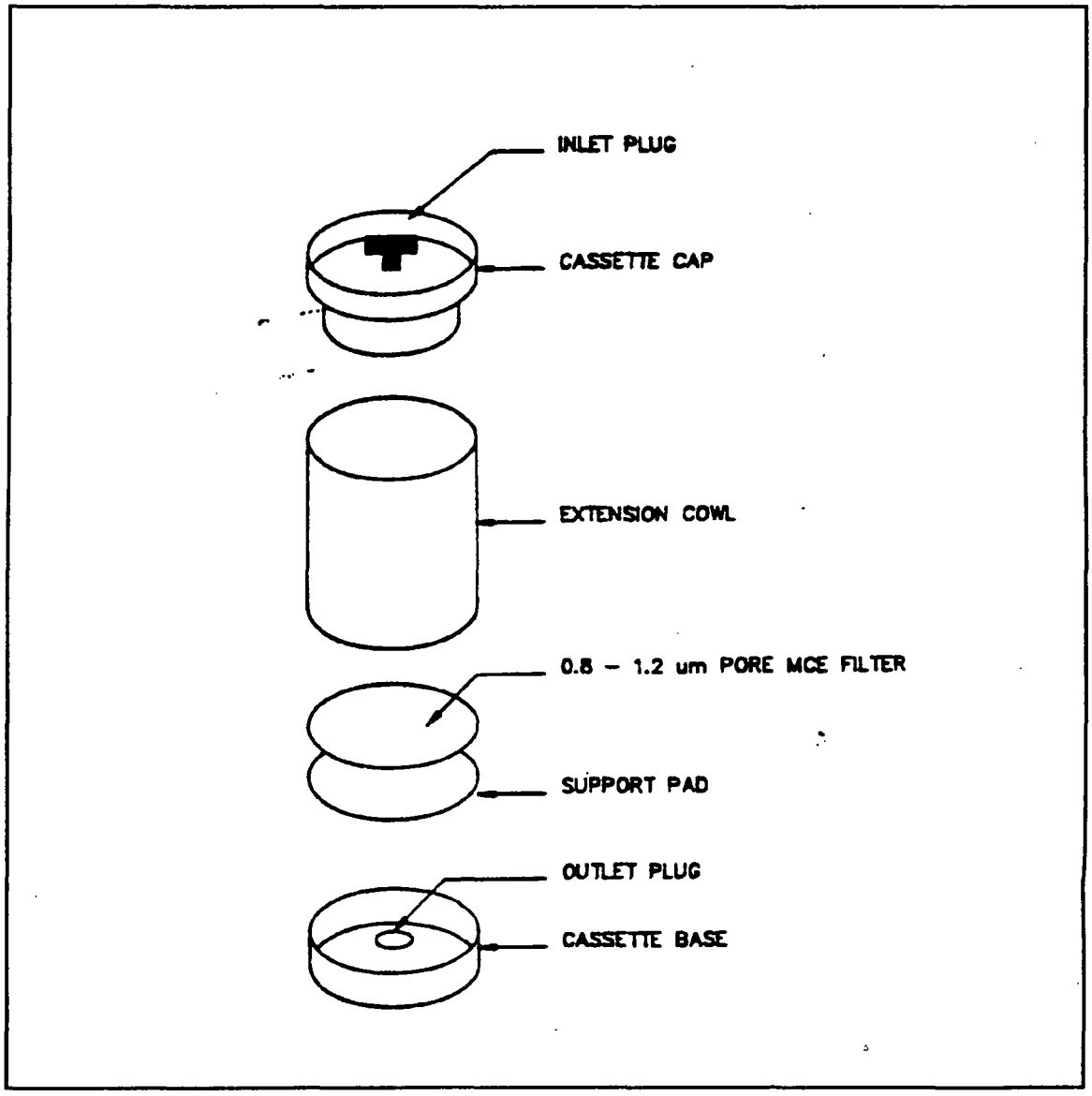
FIGURE 1. Transmission Electron Microscopy Filter Cassette



APPENDIX B (Cont'd)

Figures

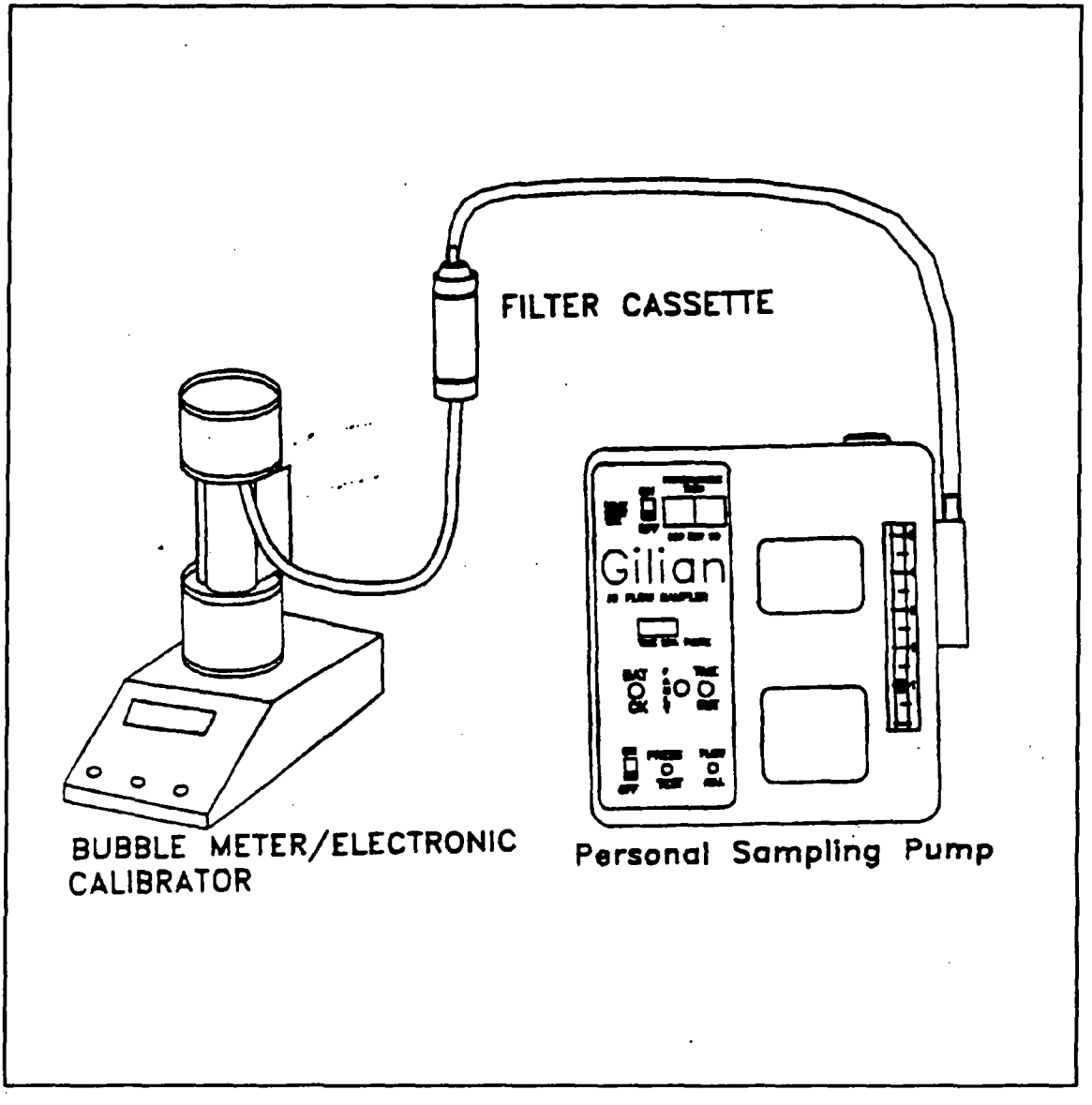
FIGURE 2. Phase Contrast Microscopy Filter Cassette



APPENDIX B (Cont'd)

Figures

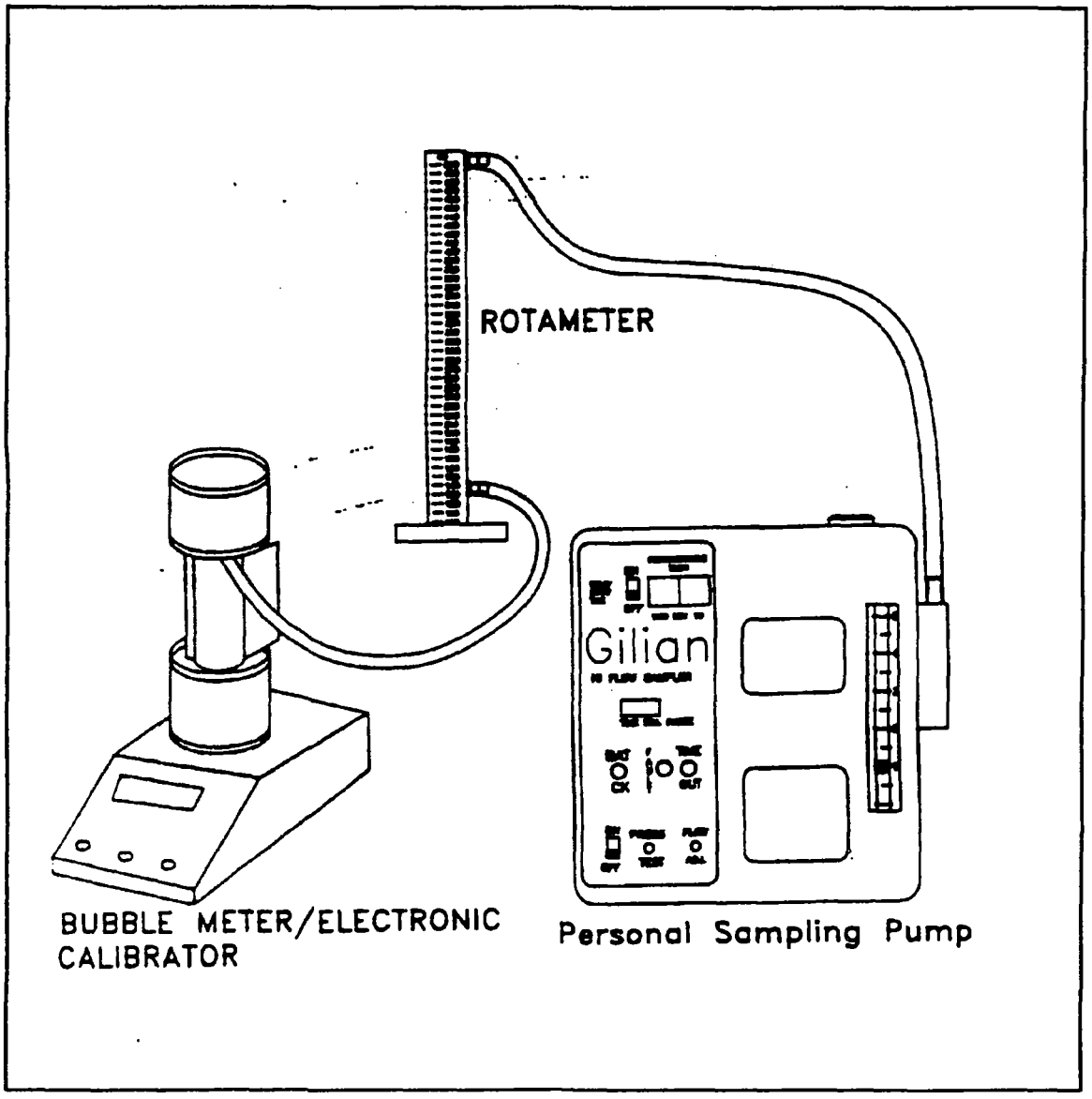
FIGURE 3. Calibrating a Personal Sampling Pump with a Bubble Meter



APPENDIX B (Cont'd)

Figures

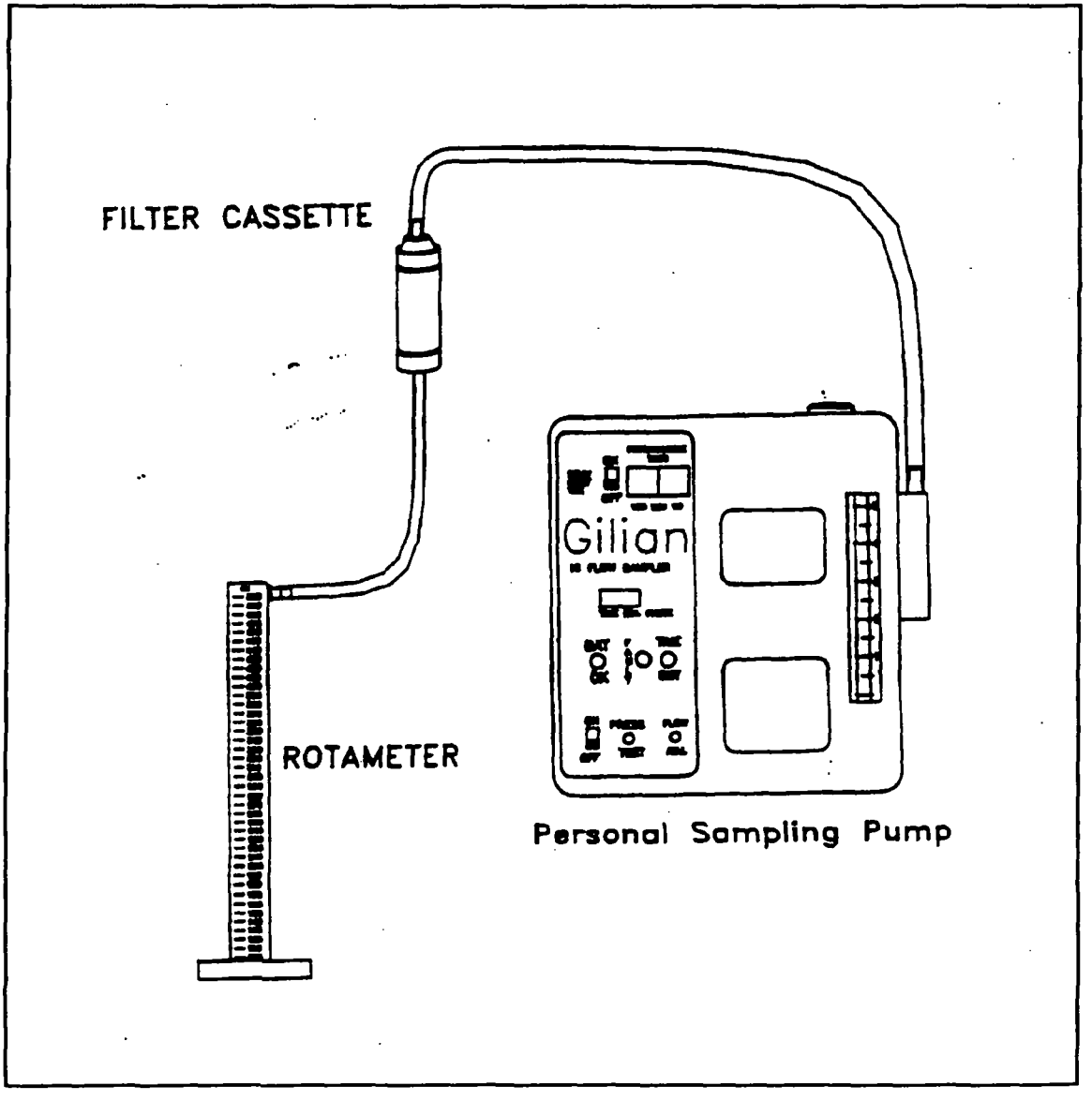
FIGURE 4. Calibrating a Rotameter with a Bubble Meter



APPENDIX B (Cont'd)

Figures

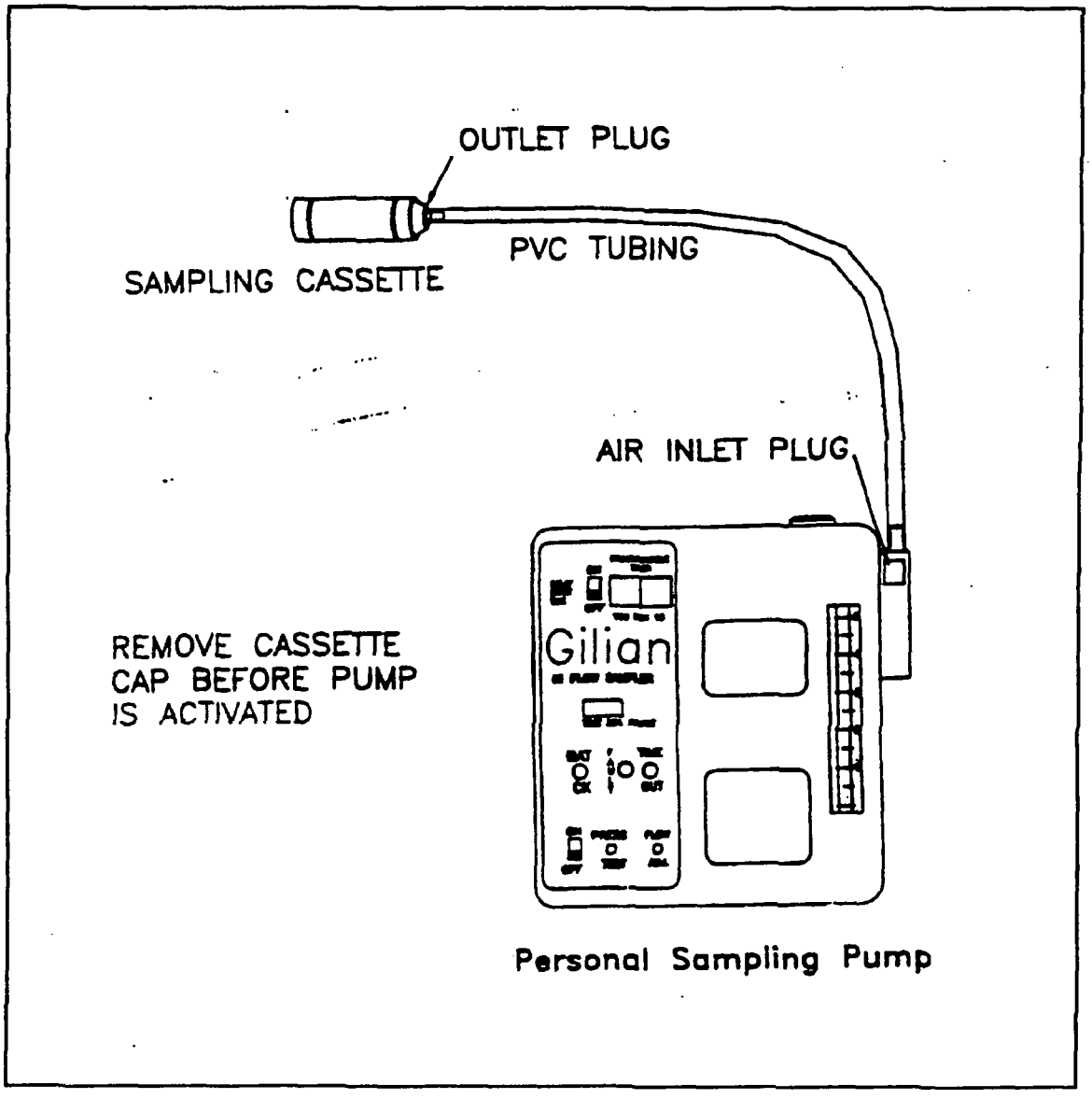
FIGURE 5. Calibrating a Sampling Pump with a Rotameter



APPENDIX B (Cont'd)

Figures

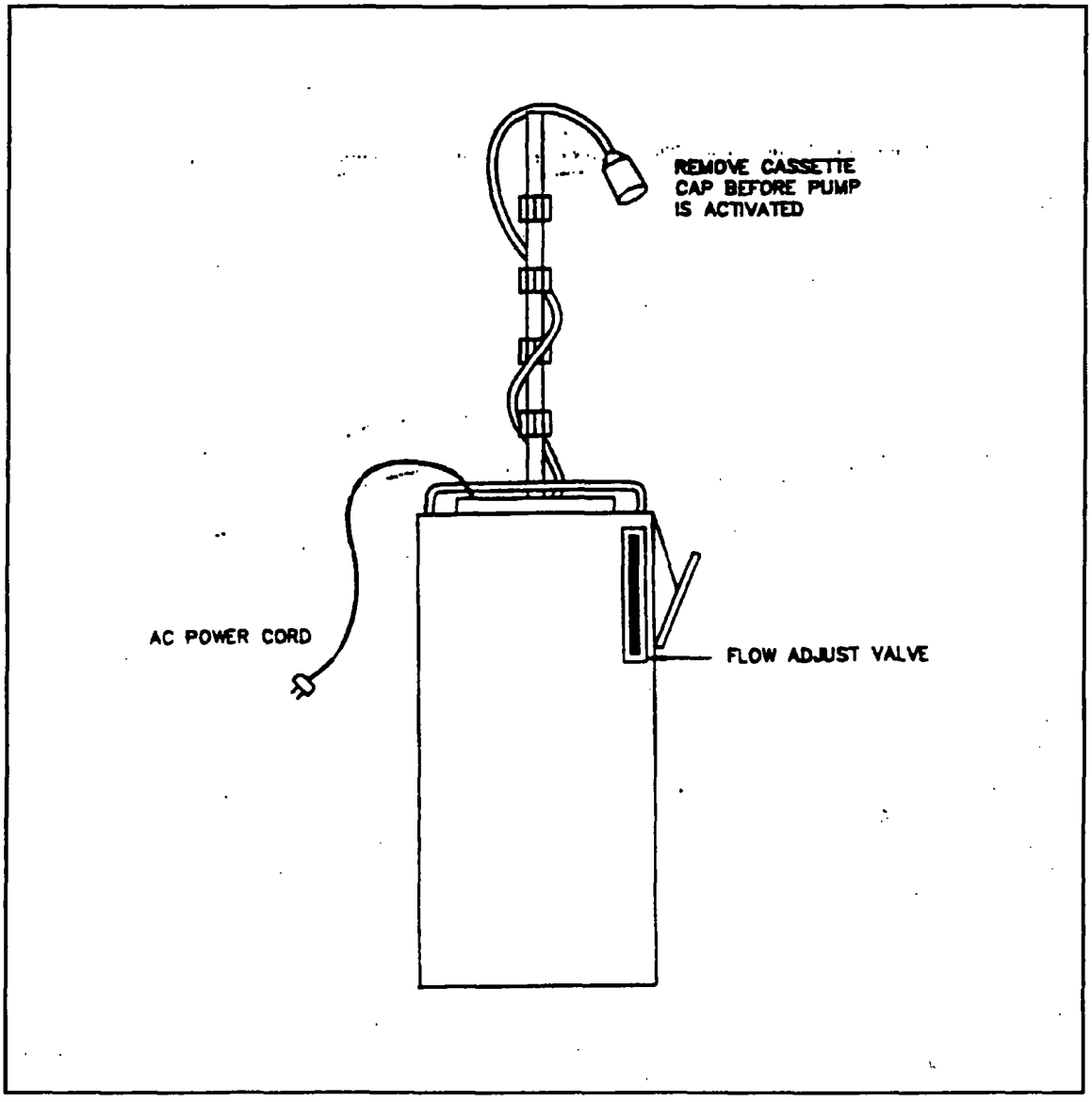
FIGURE 6. Personal Sampling Train for Asbestos



APPENDIX B (Cont'd)

Figures

FIGURE 7. High Flow Sampling Train for Asbestos



Appendix B
Field Sample Data Sheet

Sheet No.: SA-**00«seq»**

LIBBY FIELD SAMPLE DATA SHEET (FSDS) FOR STATIONARY AIR

Field Logbook No: _____ Page No: _____ Sampling Date: _____

Address: _____ Owner/Tenant: _____

Business Name: _____

Land Use: Residential School Commercial Mining Roadway Other ( )

Sampling Team: MACTEC CDM Other _____ Names: _____

Data Item	Cassette 1	Cassette 2	Cassette 3
Index ID			
Location ID			
Sample Group			
Location Description			
Category (circle)	FS FB-(field blank) LB-(lot blank)	FS FB-(field blank) LB-(lot blank)	FS FB-(field blank) LB-(lot blank)
Matrix Type (circle)	Indoor Outdoor NA	Indoor Outdoor NA	Indoor Outdoor NA
Filter Diameter (circle)	25mm 37mm	25mm 37mm	25mm 37mm
Pore Size (circle)	TEM- .45 PCM- 0.8	TEM- .45 PCM- 0.8	TEM- .45 PCM- 0.8
GPS Status (circle)	Collected Not Collected-no signal (3 attempts) Not Collected-not required for sample	Collected Not Collected-no signal (3 attempts) Not Collected- not required for sample	Collected Not Collected-no signal (3 attempts) Not Collected- not required for sample
GPS File (fill in or circle)	Filename:_____ NA	Filename:_____ NA	Filename:_____ NA
Flow Meter Type (circle)	Rotometer DryCal NA	Rotometer DryCal NA	Rotometer DryCal NA
Pump ID Number			
Flow Meter ID No.			
Start Date			
Start Time			
Start Flow (L/min)			
Stop Date			
Stop Time			
Stop Flow (L/min)			
Pump fault? (circle)	No Yes NA	No Yes NA	No Yes NA
MET Station onsite? (circle)	No Yes NA	No Yes NA	No Yes NA
Sample Type (circle)	Pre Post Clear 2nd Clear 3rd Clear NA	Pre Post Clear 2nd Clear 3rd Clear NA	Pre Post Clear 2nd Clear 3rd Clear NA
Field Comments Cassette Lot Number:_____ (For lot blanks only)	Archive Blank (circle): Yes No	Archive Blank (circle): Yes No	Archive Blank (circle): Yes No
Entered (LFO): _____	Volpe: Entered _____ Validated _____	Volpe: Entered _____ Validated _____	Volpe: Entered _____ Validated _____

For Field Team Completion (Provide Initials)	Completed by:	QC by:

vs 040706

Appendix C
Outdoor Ambient Air Sampling Program
Daily Impact/Observation Memorandum

OUTDOOR AMBIENT AIR SAMPLING PROGRAM
DAILY IMPACT/OBSERVATION MEMORANDUM

This report represents a summary of observations made during the day that could potentially impact the results of samples collected as part of the outdoor ambient air sampling program as described in the *Final Sampling and Analysis Plan for Ambient air Monitoring at the Libby Asbestos Site* (CDM and SRC 2006).

Date:
From:

REMOVAL/REMEDIAL ACTIONS

Describe all removal actions being conducted at the Libby Site by completing the following table.

Address of Removal/Remedial Action	Describe Action

OTHER OBSERVED ACTIVITIES

Describe all other observed activities that could affect sample results by completing the following table.

Potentially Impacted Sample Locations	Describe Activity	Estimated Proximity to Sample Location

EQUIPMENT ISSUES

Describe all equipment issues that could affect sample viability by completing the following table.

Potentially Impacted Sample Locations	Issue	Describe Action Taken to Rectify Issue

DEVIATIONS FROM GUIDANCE DOCUMENT

Describe previously undocumented deviations related to the ambient air program by completing the following table.

Potentially Impacted Sample Locations	Describe Deviation	List Mod Form Number Completed

OTHER ISSUES

Describe any other issues or observations that could impact sample results or viability (adverse weather, city street sweeping activities, nearby wildfires, etc.).

Appendix D
Record of Deviation Form

Record of Modification

to the

Libby Sampling and Quality Assurance Project Plan

Field Activities

LFO-0000__

Instructions to Requester: **Fax to contacts at bottom of form for review and approval.**
File approved copy with Data Manager at the Libby Field Office (LFO).
Data Manager will maintain legible copies in a binder that can be accessed by LFO personnel.

Project QAPP (circle one): Phase I (approved 4/00) Phase II (approved 2/01)
Removal Action (approved 7/00) Contaminant Screening Study (approved 5/02)
Other (Title and approval date):_____

SOP (Number and Revision No.):_____
_____
_____

Other Document (Title, Number/Revision): _____

Requester: _____ Title: _____
Company: _____ Date: _____

Description of Modification (attach additional sheets if necessary; state section and page numbers of SQAPP when applicable):_____
_____
_____
_____

Field logbook and page number Modification is documented on: _____

Implications of Modification: _____
_____
_____
_____

Duration of Modification (circle one):
Temporary Date(s):_____
Resident address(es): _____
_____

- If appropriate, attach a list of all applicable Index Identification numbers.

Permanent (complete Proposed Modification Section) Effective Date:_____

Potential Implications of Modification:_____
_____
_____
_____

Technical Review and Approval: _____ Date:_____
(Volpe Project Manager or designate)

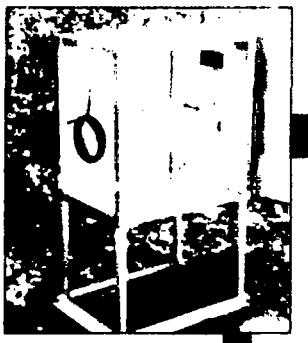
EPA Review and Approval: _____ Date:_____
(USEPA RPM or designate)

Appendix E
Example of Equipment Shelter

CUSTOM TAILORED SMALL INSTRUMENT SHELTER NON WALK-IN TYPE

Ekto Manufacturing Corporation
Mobile Insulated Equipment Shelters

New e-mail address
Info@ekto.com



Ekto Equipment Shelters: Custom Designed Optimal Performance

Stationary or Mobile Shelters for:

Instrument Enclosures
Continuous Emissions Monitoring Sites
Air Monitoring Stations
Communication Earth Stations
In-Process Monitoring

STANDARD AND CUSTOM DESIGNS

Corrosion resisting prefinished, baked-on enamel aluminum exterior skins. Epoxy vacuum bonded sandwich construction.

APPLICATIONS

Enclosures to safely house delicate instruments, data gathering equipment, analyzers etc. in various environmental conditions.

STRUCTURAL

Lightweight aluminum construction
Insulation R5 to R12
Units on legs or skids with tie down provisions

DOORS

Fully gasketed
Continuous stainless steel piano hinge
Lockable positive latch
Full opening front or front and rear

CLIMATE CONTROL

Air conditioner with thermostat
Heater with thermostat
Natural or forced air vented

ELECTRICAL

120/220V, 50/60Hz, 15A to 30A operation
Power supply cord
Main breaker
Power strip, surge protected
Light

INTERIOR

Standard 19" equipment rack
Shelves, fixed or sliding

Ekto Manufacturing Corporation
Sanford Industrial Estates
Eagle Drive
P.O. Box 449
Sanford, ME 04073 USA
Tel: 207-324-4427
Fax: 207-324-4667
E-mail: ekto@cybertours.com
www.ekto.com

CUSTOM SIZES TO MEET YOUR APPLICATIONS

Ekto Shelter Construction

MODULAR OR MOBILE WALK-IN OR NON WALK-IN ENVIRONMENTS